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Annual Report of the Agricultural Chemist for 1926.

STAFF.

The work of the Division was somewhat handicapped throughout the year by changes in staff. Major Eaton was appointed to act as Secretary for Agriculture from February 9th to April 23rd; and was seconded for service with the Rubber Research Institute from November 1st. Mr. R. O. Bishop was absent from the Division while acting as Plant Physiologist and working in the Plant Physiologist's Laboratory until November 1st and later was appointed to act as Agricultural Chemist. Major Georgi acted as Agricultural Chemist from February 9th until April 23rd.

Mr. Greenstreet was absent on service leave until March 3rd.

Mr. Dennett was absent on service leave until October 26th.

RUBBER INVESTIGATIONS.

In addition to the usual vulcanisation work investigations on latex and on rubber were carried out continuously until the close of the year. The work was devoted to problems connected with the following:—

Preservation of latex and its evaluation.

The storage of raw rubber. The effects of mechanical impurities in raw rubber. The variation in tensile strength of rubber.

The accelerating properties of some alkaloids during hot vulcanisation.

Records of the results obtained in these investigations have already been published in the Malayan Agricultural Journal or are in course of preparation.

The relative merits and demerits of alum as a coagulant have been made the subject of a special enquiry with the result that the action of the Department of Agriculture condemning the use of alum has received the support of the

large consumers in Europe and America who, it appears from the correspondence, still continue to find plantation rubber lacking in uniformity. In this connection particular interest is attached to the results obtained from an examination of a series of samples which were collected from rubber exhibits shown at various Agri-Horticultural Shows in different parts of the country. The record of that examination will appear shortly in the Malayan Agricultural Journal.

After Major Eaton's transference to the Rubber Research Institute no further rubber work was commenced and although in the latex investigation some chemical work remains to be completed it has been possible to hand over to the Rubber Research Institute the majority of the apparatus and machinery necessary for carrying out the vulcanisation and testing of rubber.

Soils.

The soil investigations which remained in abeyance during Mr. Greenstreet's absence on leave were resumed in April but progress was slow owing to the number of analyses required in connection with soil surveys for special purposes.

Reports were issued on 11 areas of land, of which 3 were under consideration for planting padi, 6 for planting oil palm and 2 for rubber cultivation. These reports and others carried out at the request of various estates involved the examination of 203 samples of soil.

The investigations relating to soil impoverishment consequent on the growth of tapioca necessitated an enquiry into methods of analysis. Some useful preliminary work has been completed and a report is in course of preparation.

Crops Grown and Cultivated at the Government Experimental Plantation, Serdang.

In the early part of the year a systematic examination was made of the sugar contents of twenty-two varieties of cane, and sugar-content determinations were undertaken at regular intervals to ascertain the optimum time for harvesting the different varieties under cultivation. The results were reported to the Agriculturist. The examination of fibres grown at Serdang has suffered somewhat owing to the lack of staff available for the work. The pita or arghan fibre has been compared with that produced on an estate in Negri Sembilan and the results are now available for publication. There is evidence to show that the pita plant leaves do not yield more than 2 per cent of fibre and the fibre does not possess exceptional qualities. Work on sisal hemp has been continued and the records show that the fibre being grown at the Government Experimental Station is of good quality.

Other produce from Serdang which has received attention is anatto, gambier, kapok and tuba. A preliminary report on kapok is being completed and contains the results of an investigation into the methods adopted for the examination of this material.

The work on gambier and tuba involves the periodic examination of crops from several plots and will be somewhat prolonged.

Fibres.

In addition to those fibres grown at Serdang the investigation on terap fibre has been continued. As a result of submitting samples to experts in Lancashire an offer was received from Jute Industries Ltd. through the Cotton Fine Spinners to spin and weave a suitable batch of the fibre and a consignment of 3 cwt. of material prepared from trees grown in blukar at Serdang is now ready for despatch. With the completion of this and the year's records on tree girth development it will be possible to publish a report on the investigation.

Jelutong.

Work on this material was undertaken at the request of the Forest Department and has been continued throughout the year. A preliminary report on coagulation of the latex was published in the Malayan Agricultural Journal in September.

Satisfactory progress has since been made on an improved method of coagulation together with methods of preservation.

As a result of these investigations it has been found possible to treat successfully on a commercial basis the daily output of latex from the Weld Hill Forest Reserve. A record of this work will be published in the Malayan Agricultural Journal in due course.

Nipah.

Investigations on alcohol production from Nipah sap were discontinued until after Mr. Dennett's return from furlough. Since then the chemical work has been devoted to laboratory technique appertaining to a simplified method for the rapid estimation of alcohol, acid and sugar in fresh sap.

Tapping records are being collected from the palms in bearing on the experimental plot at Jeram, and observations are also being made in connection with the tapping experiments in progress on two estates.

It has not been found possible to carry out any further investigations on the production of alcohol from tapioca or similar carbohydrate materials.

Fertilisers.

Particular consideration has been given to the economic conversion of waste vegetable matter into manures of practical value. The preliminary work with Adco and lallang has been encouraging and field trials with the manure are now in progress on tapioca plots at Serdang. Analyses have been carried out on two kinds of cover crops to obtain an indication of their manurial value at different stages of growth. Analyses have also been made on various guanos and locally available artificials.

Oil Palm.

In addition to the analyses carried out on samples submitted in the course of the usual estate practice a considerable volume of work has been undertaken in connection with the process of oil extraction on four estates with a view to comparing the efficiencies of the types of plant in use.

It is anticipated that the data collected will be available for incorporation in the publication on oil palm which is being prepared by the Agriculturist and Major Eaton.

Miscellaneous.

Miscellaneous investigations have embraced a wide range and reports have been issued on the following:—

Alkaloidal content of ipecacuhana root from Serdang.
Nicotine content of tobacco.
Preparation of rubber seeds for export.
Shelling of candlenuts.
Examination of minyak medang losoh (Cinnamomum parthenoxylon).
Manila hemp from Serdang.
Rice bran as a cattle fodder.
Analyses of water for irrigating padi areas.
Bleaching and deodourising of palm oil.
Examinations of samples of papain.
Examinations of samples of coal.
Examination of tapioca refuse received from Sandakan.
Report on adhesives for the Forest Research Officer.
Tapping and extraction of guttapercha.
Comparison of local chinese wood oil with that obtained from Shanghai and Hankow.
Examination of minyak sepetir.
Examination of a sample of Malayan lac.
Examination of soap nuts (Sapindis saponaria).
Report on the oil content and characteristics of the oil obtained from Piquia fruits.

During the year assistance has been rendered to the Agri-Horticultural Association in connection with the judging of exhibits at local shows, and the Agricultural Chemist prepared a representative exhibit of crops other than rubber for display in Paris at the Seventh International Exhibition of Rubber and Allied Products.

Publications.

The following articles were published in the Malayan Agricultural Journal during the year by the Staff of the Division:—

The Acceleration of Vulcanisation by Alkaloids. B. J. Eaton and R. O. Bishop, Vol. XIV, No. 1.

Gambier (*Uncaria Gambier*). Its Extraction and Valuation. B. J. Eaton and R. O. Bishop, Vol. XIV, No. 2.

Variations in the Tensile Strength of Rubber—Sulphur Vulcanisates. B. J. Eaton and R. O. Bishop, Vol. XIV, No. 3.

Essential Oil from Medang Lesoh (*Cinnamomum Parthenoxylon*). B. J. Eaton and Gunn Lay Teik, Vol. XIV, No. 4.

Malayan Guano Deposits. V. R. Greenstreet, Vol. XIV, No. 5.

Jelutong. B. J. Eaton, C. D. V. Georgi and Gunn Lay Teik, Vol. XIV, No. 9.

Oil from *Aleurites Trisperma*. C. D. V. Georgi, Vol. XIV, No. 9.

Oil from Aleurites Species. C. D. V. Georgi, Vol. XIV, No. 9.

The Effects of Effluents from Rubber Factories on Padi and their Treatment. B. J. Eaton, Vol. XIV, No. 9.

Chinese Wood Oil and Candlenut Oil. B. J. Eaton and C. D. V. Georgi, Vol. XIV, No. 11.

Manuring of Rubber Estates. B. J. Eaton and F. G. Spring, Vol. XIV, No. 11.

The Nipah Palm, Further Investigations on Tapping and Preservation of the Juice. J. H. Dennett, Vol. XIV, No. 12.

Annual Report of the Chief Field Officer for 1926.

STAFF.

The Field Division remained throughout the year in the charge of the Chief Field Officer, Mr. F. W. South, who returned from furlough and relieved Mr. F. Birkinshaw on the 1st January 1926.

The Agricultural Field Officers were distributed as follows:—

FEDERATED MALAY STATES.

Perak North.	Mr. F. Birkinshaw who ceased to act as Chief Agricultural Field Officer and returned to Taiping on the January, 1926.
Perak South.	7th January to 31st December, 1926, Mr. A. E. Coleman Doscas, transferred from Malacca.
Selangor.	1st January to 26th February and 8th October to 3rd December, 1926, Mr. G. E. Mann, transferred from Taiping on the 1st January, 1926. 27th February to 7th October, Mr. F. W. South, Chief Field Officer, in addition to his own duties, during the absence of Mr. Mann on vacation leave in Europe. 4th to 31st December, Mr. R. B. Jagoe, a newly appointed officer who took Mr. Mann's place when the latter was appointed Agricultural Instructor (Malay Officers).
Negri Sembilan.	Mr. W. H. Barnes.
Pahang West	Mr. J. W. Jolly, transferred from Perak South on the 1st January, 1926.
Pahang East.	1st January to 15th December, Mr. J. C. Sworder, 16th to 31st December, 1926, Captain J. M. Howlett, transferred from the appointment of Agricultural Instructor (Malay Officers) after his return from leave on the 4th December, 1926.

Mr. R. B. Jagoe was appointed an Agricultural Field Officer on the 10th September and reported for duty on the 8th October, 1926. From then until the 4th December he assisted the Chief Field Officer and later the Agricultural Field Officer, Perak North, while gaining experience of his duties.

STRAITS SETTLEMENTS.

Province Wellesley & Penang.	1st January to 10th April and 18th to 31st December, 1926, Mr. F. R. Mason. 11th April to 17th December, Mr. F. Birkinshaw, Agricultural Field Officer, Perak North, in addition to his own duties, during the absence of Mr. Mason on vacation leave in Europe.
Malacca.	Mr. J. Fairweather who returned from vacation leave on the 31st December, 1925 and relieved Mr. Doscas on the 1st January, 1926.
Singapore.	Mr. F. W. South, Chief Field Officer, in addition to own duties, no new officer being available to fill this vacancy throughout the year.

Mr. F. de la Mare Norris continued to hold the appointment of Acting Inspector of Agriculture, Johore, throughout the year.

The Advisory Committee for Chinese Agriculture is still composed of the following members:—

The Secretary for Agriculture (Chairman);

The Chief Agricultural Field Officer;

Mr. Khoo Keng Hooi, J.P.;

Mr. Yap Tai Chi, J.P.;

Mr. Yap Tai Seng.

It is with deep regret that I have to record the death of the Junior Agricultural Assistant, Province Wellesley North, Inche Mohamed Zain bin Mohamed Haniff, on the 27th April after an illness necessitating his absence from duty on sick leave from December 1925.

The Senior Agricultural Assistant, Inche Mohamed Noor bin Hamzah, resigned his appointment as Agricultural Officer, Kedah, on the termination of his agreement on the 31st October. He was replaced by Raja Mohamed bin Raja Aman who had previously been Senior Agricultural Assistant, Teluk Anson. Inche Mohamed Noor, on his return from Kedah, was appointed Senior Agricultural Assistant in the Botanical Division and was stationed at the Titi Serong Padi Experiment Station, Krian. Certain other transfers were made among Malay Officers in the States of Perak and Pahang during the year, as occasion required, some being necessitated by the serious illness of two Malay Officers. One of these the Junior Agricultural Assistant, Inche Uda bin Samsudin, had to be transferred, in the in-

terests of his health, from Taiping to Kuantan on the 6th November, following a period of leave which commenced on the 27th April.

There were no Apprentices ready to qualify for promotion to the Grade of Junior Agricultural Assistant during the year. Consequently there were several vacancies in the Staff of the Field Division. To carry on the work efficiently it was found necessary to employ experienced Notice Servers and other suitable Malays as Temporary Inspecting Officers. Five such were employed in Malacca, one in Province Wellesley and three in Perak.

During the year four appointments provide for Padi Inspectors were filled, two being in Selangor, one in Pahang and one in the Negri Sembilan. The Officers from Selangor and Pahang were sent to the Titi Serong Padi Experiment Station for training during planting operations from the 21st September to the 31st October. It is intended to send these officers to Titi Serong again during the harvest operations in the coming year. The Officer from the Negri Sembilan was sent to the Pulau Gadong Padi Experiment Station in Malacca on the 16th September and will remain there until after the harvest next year.

ESTATES VISITED.

Area.	Estates.	Visited by request	Visited more than once.
Penang and Province Wellesley	13	5	3
Perak North ...	8	8	3
Perak South ..	19	9	1
Selangor ...	10	7	2
Negri Sembilan ...	17	—	6
Pahang West ...	13	4	4
Pahang East ...	None	recorded	
Malacca ...	11	5	1
Singapore ...	1	1	—
Johore .	113	31	27
Extra visits by the Chief Agrl. Field Officer ...	4	2	—
Totals ...	209	72	47

The total of 209 estates visited in 1926 compares with 275 visited in 1925 and 201 in 1924. The great majority of these visits were made, either in the course of routine inspections, or to give advice on the control of diseases and pests of rubber, coconuts, oil palm, coffee and taban merah (Gutta

percha). Thirteen visits were made in connection with soil improvement or manurial experiments; two to advise on coconut cultivation; two to inspect food production areas, and seven at the request of Land Officers. The cultivation of fruit trees, pita fibre and tobacco, the growth of cover crops, and the production of papain accounted for the remaining seven visits.

Rubber.

(i) *General.*

The average price realised for rubber during the year was sufficient, especially when forward contracts are taken into consideration, to maintain all properties in good order and yield a satisfactory profit to owners or shareholders. Partly as a consequence of this there has, on the whole, been a steady improvement in the condition of the smaller holdings, many of which are now reasonably tidy and free from excess of undergrowth. This is particularly noticeable in the Dindings where the work of the Agricultural Officer, first stationed there 18 months ago, is now showing definite results. The improvement would, however, not have been effected without the continued efforts of Agricultural Officers; it is largely the outcome of the practice of refusing a full allowance of export coupons to owners whose land is not maintained in a condition to justify the expectation of an average output of rubber per acre. In a few of the more remote localities, as for instance along the banks of the Perak and Kinta rivers in Lower Perak district, small holdings are still badly neglected and will require much further attention from Agricultural Officers in the coming year.

It is regrettable that the unsatisfactory practice of farming out rubber holdings on the profit sharing basis is still very prevalent among Malays. This practice naturally leads to extravagant systems of tapping, and neglect of general upkeep and disease control, since the farmer's only interest is to get as much rubber out of the property as he can, while the owner exercises little or no supervision and usually has no contract giving him legal control over the farmer's treatment of the property. This system also tends to increase the difficulties experienced by Agricultural Officers in their endeavours to enforce disease control and the proper general maintenance of such properties.

Certain Companies are evincing considerable interest in experiments with a view to restoring the fertility of soil in fields where it has become very poor, mainly owing to the effects of continuous and heavy "washing" in past years. In such fields the starved and stunted trees can no longer be tapped at a profit. The methods under trial vary considerably according to the actual conditions. Silt pitting and the encouragement of a growth of weeds, or of green manures,

to provide humus, usually form the basis of such experiments, though chemical fertilisers are also used, particularly ammonium sulphate and ammonium nitrate, either alone, or in conjunction with silt pitting and green manures. In some cases the old rubber trees have been cut out and the areas have been replanted, but only after silt pits have been dug and the green manures have definitely commenced to improve the texture and fertility of the soil.

Silt pitting and the growth of cover crops are now beginning to form part of the ordinary upkeep of the larger Estates owned by Asiatics, in the same way as they now do generally on European properties.

Certain estates in Kedah, Selangor and Johore have imported large quantities of bud-wood from selected stock in Sumatra and have used it to establish young clearings of budded trees. In a few instances selected seed from Sumatra or Java has also been imported for planting new clearings. All consignments of such material enter the Peninsula only with the written permission of the Secretry for Agriculture or the Inspector of Agriculture, Johore and have to be accompanied by a certificate of freedom from diseases and pests signed by a properly qualified officer in the Dutch East Indies.

The erection of the necessary plant for the preparation of sprayed rubber was in progress in Singapore during the year. When completed, several of the larger Johore estates will send their latex in railway tank-trucks to this factory. It was anticipated that the factory would be working early in 1926, but arrangements were not completed until the close of the year.

Owing to the lack of firewood for smoking purposes in the Province one estate has decided to plant up twenty acres with quick growing trees for this purpose. A commencement has been made with Casuarina trees of which the seeds sown have germinated well. Trials are to be made with other species of trees suggested by the Forest and the Agricultural Departments.

(ii) *Diseases and Pests.*

The first four months of the year were remarkably hot and dry causing, in February, the most thorough and simultaneous wintering of the rubber trees throughout the Peninsula, that has been seen for several years. This had a beneficial effect in controlling bark diseases generally, so that Mouldy Rot and Pink disease in particular were little in evidence during the first half of the year.

Pink Disease.—(*Corticium salmonicolor*, B. & Br.). This disease was newly reported from 5 estates in Johore

during the year, there were no other new reports. In the dry first half of the year the disease was comparatively quiescent, except in small rubber holdings along the Pahang River in Kuala Lipis and Temerloh Districts, in a Chinese Estate in the latter district, and on small holdings in Kuala Lumpur district. On the Pahang River the cases had not been treated for some time and continuous careful attention to this area was necessary; the other two outbreaks were promptly treated. Showers later in the year caused new outbreaks at Ulu Serting and Kipis in Negri Sembilan and the usual recrudescence of the disease in Ulu Selangor district. The serious attacks in these places were, as usual, on young trees under six years old. Cases also occurred fairly regularly in Upper Perak district. On the whole the disease now does far less damage to rubber than it did some few years ago. This is partly due to the fact that in many places there are few trees of a susceptible age, most being over 6 years old, so that attacks are far less numerous and are mainly confined to small outer branches, or to old infections that become active in favourable weather conditions. It is also partly due to improved knowledge of the disease and its treatment resulting from the continuous work of the Field Officers. Most small holders will not take any action to treat the disease until they receive notices to do so, but they seldom now fail to carry out the instructions given. This is clearly shown by the fact that, while 156 persons were prosecuted for failure to treat this disease in 1920, only 37 prosecutions were found necessary this year.

Mouldy Rot.—(*Sphaeronema fimbriatum*. E. & H.). This disease was newly reported from 8 estates in Selangor, 2 in Pahang West, 6 in Malacca, 7 in Johore and 1 in Singapore. It was not much in evidence in many localities during the dry first six months of the year. Showery and wet weather later led to its recrudescence in all the previously infected localities and to new infections in a number of places.

In Province Wellesley a new outbreak was discovered at Paya Keladi in January, this was effectively controlled and did not reappear. The attack discovered on the boundary at Junjong in December 1925, after disappearing for about 6 months, broke out again in September and spread slowly in spite of the activities of the Inspecting Officers. In Perak North there were new infections at Ayer Kuning in Larut District, at Kampong Changkat, at the first mile on the Kenas Road and at Lawin at the 20th mile on the Taiping—Kuala Kangsar road in Kuala Kangsar district. In Batang Padang district, Perak South, there was an outbreak for the first time on seven small holdings at Kampong Gembol near Sungkai in June. Prompt control measures appear to have been quite effective, as the disease has not, so far, reappeared there. In Selangor there were recrudescences of the disease at Beranang and Sepang at the end

of the year. In Kuala Lumpur district its control required constant attention throughout the second half of the year and it spread to several areas adjoining those previously infected. In Pahang during the first quarter of the year there were outbreaks of the disease in two new centres, one at the 29th mile Raub and the other at Kampong Tedong in Semantan mukim of Temerloh District; another new outbreak occurred in the third quarter in small holdings surrounding Kuala Lipis. In Malacca and Johore there has been no important spread of the disease to new areas. In Singapore Island there was a new outbreak in one locality in August. It spread rapidly during wet weather at the end of the year, so that by December many properties in the centre and east of the Island had recently become infected.

In October, at the request of the Kedah Government, the Chief Agricultural Field Officer made a report on the control of Mouldy Rot disease in South Kedah where there had been a considerable extension of the area first found to be infected at the end of 1925.

Control measures are in nearly all cases applied successfully on larger estates; in many localities better work is now done on small holdings and the necessity for the work is better understood, but in some educative action and persistent pressure are still necessary before anything effective is done. The measure that always proves the most difficult to enforce is the cessation of tapping during treatment, a measure without which effective control is impossible.

Black Stripe.—(*Phytophthora* sp.). This disease was newly reported from 3 estates in Malacca and 1 in Perak South. One outbreak in Malacca did damage before it was got under control. None of the others were serious. Cases have been found in most States but the disease has been of little importance.

Patch Canker.—(*Phytophthora* sp.). Advice was asked regarding the control of this disease by the Managers of two estates in Perak North and one in Selangor early in the year. There are indications that this disease may become increasingly important in low lying damp situations as the trees grow older.

Root Diseases.—Recent examinations of the older estates in Selangor and elsewhere have revealed a high percentage of trees, from 15 to 20 years old, infected with Wet Rot, *Fomes pseudoferreus*. Wakefield, or Dry Rot, *Ustulina zonata* (Lev.) Sacc. These fungi became strongly established in the fields, on old jungle stumps or thinned out rubber trees, in the days before the need for the removal of decaying timber was appreciated. The former in particular has continued to spread very insidiously, since trees in the early stages of attack show no symptoms above ground. The treat-

ment of Wet Rot under these conditions has been under consideration by the Mycologist whose conclusions are published in the *Malayan Agricultural Journal* Vol. XIV p. 32. He points out, however, that treatment is economically sound only when the disease is tackled in the earlier stages and the percentage of infected trees is not too high. In cases where the percentage of trees badly infected by one or the other of these diseases is really high, the soundest policy would seem to be to allow them to take their course, getting all the rubber possible from the trees in the meantime; to remove carefully and burn the trees as they die; and eventually to replant the field. There is little doubt that the incidence of these two principal root diseases of old rubber trees deserves more attention than is given to it on many estates.

Coconuts.

(i) *General.*

There was a large crop of nuts of good quality in most places during 1926 and this factor is partly responsible for the increase in exports.

The slow but steady extension of coconut cultivation is a satisfactory feature of agriculture in Malaya during recent years, since it shows that this Cinderella of our local crops is beginning to be appreciated at its true worth. On carefully chosen land and with proper care and management coconuts are capable of providing reliable and adequate, if unsensational, profits. Unfortunately lack of suitable land must before long put an end to expansion in Perak, Selangor and Negri Sembilan where rubber, the all pervading, has forestalled or dispossessed the coconut.

In my annual report for 1923 (*Malayan Agricultural Journal* Vol. XIV p. 232), I gave reasons why the coconut industry is particularly suitable for Malay small holders. This opinon is supported by the fact that in Johore the coconut industry is, almost entirely, in the hands of small holders, collection of the nuts and preparation and export of the copra being well organised.

(ii) *Pests and Diseases.*

Black Beetle.—(*Oryctes rhinoceros* L.) Routine inspections have kept this insect well under control in Malacca and Negri Sembilan and have resulted in a further reduction in the number of breeding grounds suitable to it in Province Wellesley, Penang, Kinta District of Perak and parts of the coast districts of Selangor. In Singapore Island the spread of the town into the rural area has necessitated the felling of a number of coconut palms, of which the proper disposal has required attention. Difficulty is still experienced at times in preventing the accumulation of

rubbish heaps near incinerators and in the vicinity of buildings, of manure heaps near bullock stables and of sawdust in yards. At one or two pineapple canning factories the refuse left after preparation of the fruit, is accumulated in large heaps which, besides being insanitary, provide along their edges breeding grounds in which Black Beetles develop prolifically. The Department is giving attention to the possibility of utilising this refuse for the preparation of liquid fuel and manure, but in the meantime its more suitable disposal is a problem of considerable difficulty. Other considerable breeding grounds recorded during the year were provided by large accumulations of decaying nipah leaves at one or two, somewhat remote places on the river in Lower Perak district, where cigarette wrappers are prepared from nipah leaves for sale in the Penang market. Beetles from these breeding grounds attacked the nipah palms close by, as well as coconuts in the vicinity.

The Red Stripe Weevil.—(*Rhynchophorus schach* Oliv.) has not been much in evidence during the year.

The Two-Coloured Leaf Beetle.—(*Plesispa reichei* Chap.) did damage to coconuts in nurseries and newly planted areas around Sungei Ringgit in Johore. It was also found on young palms at Kukub in Johore and in Kuala Selangor District.

Hidari thrax Hubn.—The caterpillars of this skipper butterfly damaged the leaves of palms in a few localities, notably in Negri Sembilan. The outbreaks are usually only reported when the damage is done and the caterpillars have been brought under control by their natural enemies.

Salmon Pink Disease.—Diseased palms exhibiting the symptoms at present grouped together under this name have been reported from various places in Province Wellesley, South Perak, Selangor and Johore. In the latter State there has been no marked increase in the mortality of palms around Benut, though some dead and dying palms are still to be found. The Mycologist has continued his examinations of infected palms from all parts of the Peninsula and has found certain fungi associated with the somewhat variable symptoms recorded. He is still engaged on the further work necessary for the full elucidation of the cause and development of this disease, or combination of diseases, the clue to which is proving elusive.

Marasmius sp.—On one estate in Perak North a species of Marasmius did damage to young, dwarf coconuts growing on peaty land.

Bears killed some trees at Kanchong Darat in Kuala Langat District by eating the buds; Elephants destroyed a number of palms in Pahang East. Squirrels have continued to take their toll of the crop in many places.

Padi.

1. *General.*

(i) *Season 1925—1926.*

In nearly all localities planting was delayed by drought. This was followed by heavy rain and floods in December and these in turn by an unusually dry season from January till April. The crop on the whole was poor owing to the adverse weather conditions. Damage done by deep water in Penang, the Province, Krian and Larut was accentuated by the sudden outbreak of the insect *Sogata pallescens* Dist. refered to below, the Larut crop being almost a complete failure. Along the river in Lower Perak district and at Beranang in Selangor the crop was almost entirely destroyed by floods and there was insufficient padi left for seed purposes, while 1,200 acres of padi were destroyed in the same way in Malacca. The important Krian crop was considerably below the average; tillering appears to have been reduced by the floods, while the subsequent too early drying of the land, before the padi was in flower, probably caused the high percentage of empty husks observed both in Krian and the Province at harvest. There were, however, a few exceptions to the almost universally poor harvest. The crop in Upper Perak and Kuala Kangsar districts of Perak was good; in Malacca a fair average crop was reaped; some good yields were recorded from places in Western Pahang; while in Pahang East a larger area was planted and a better crop was obtained than in the previous season.

(ii) *Season 1926—1927.*

Everywhere, except in Malacca, drought delayed planting and rendered it very irregular. In Penang and the Province and the districts of Larut and Matang, and Kuala Kangsar the drought continued during the growing season and growth was, in consequence, slow until heavy showers at the end of December caused a marked improvement. But for the damage done by rats, the crop in these areas would probably have been satisfactory. In the well irrigated parts of Krian the padi has not tillered well and there is every likelihood that the Krian crop will not be up to the average. At the end of December very heavy rains in the hills caused the worst floods recorded for many years in the valleys of the Perak, Pahang and Kuantan rivers. All the growing padi in the Perak Valley was destroyed, while in Pahang the crop, some of which had been reaped and stored, was entirely swept away. Even in Raub district, away from the main river, any crop obtained will be severely reduced by the effect of the deep water standing on the fields. The growing padi in Ulu Langat district of Selangor was also damaged by floods, though the crop in any case would have been poor owing to the considerable area of unplanted sawah

and the damage due to rats and padi fly. In Kuala Selangor district, however, there was an extension of the planted area in one or two localities and a fair crop should be reaped. In Malacca the water supply has been plentiful and the padi is well forward, promising a good average crop, though about 400 acres of padi were destroyed by floods. In Negri Sembilan planting dates have been very irregular; reaping was in progress in Jelebu district in December, though in parts of Kuala Pilah district the padi had just been planted. It is, therefore, difficult to forecast what kind of crop may be expected, especially as, owing to late planting, the crop in Kuala Pilah district may prove a failure. In Johore there is little interest taken in padi planting, the total area planted in 1925—26 being only 3,866 acres. The main problems are irrigation and labour. Little expansion of the planted area is anticipated unless yields can be considerably improved, firstly by irrigation schemes, and afterwards by the introduction of improved varieties of seed.

(iii) *Experiment and Test Stations.*

The crop obtained at the Pulau Gadong Experiment Station in Malacca for the season 1925—26 was below that of the previous season owing to damage by floods and rats which appeared in large numbers at a time when the depth of water rendered trapping and poisoning impossible. The 1926—27 crop promises well, except where considerable damage has been done by rats that invaded the Station from surrounding rushes and jungle in such large numbers that it was impossible to keep them under control. All the experiments, including the selection of pure lines of local varieties of padi, are being continued.

The results obtained from the Pekan Darat Test Station in Province Wellesley were carefully recorded, but no final information is available yet. This Station suffered during the 1926—27 season from drought but had improved at the end of the year.

At the Talang Test Station in Kuala Kangsar District a good harvest was obtained in 1925—26, the average yield from Radin 13 being 450 gantangs per acre over the whole area planted with this strain, which is well suited to local conditions. Seraups Nos. 52, 48 and 36, which were under trial, also yielded well. The Manurial Experiments have been continued but no conclusive results can yet be expected. The 1926—27 crop looked well just before it was entirely destroyed by the December floods. Seraup No. 1 especially showed promise. This strain has shown itself well adapted to the deep lands of Kuala Kangsar.

At the Dong Station in Pahang satisfactory results were obtained with pure strains from Krian, notably Radin 2, Seraup Kechil No. 36 and Seraup Kechil No. 52. One

local variety known as Negri also did well and will be further tested and selected. Most of the padi for the 1926—27 season at this Station was destroyed by the December floods.

A new Test Station of about 10 acres was opened at Bota in Perak and another of 2 acres near Kajang in Selangor. The padi at the former was entirely destroyed by the floods; and that at the latter was severely damaged, so that records for the first season are likely to prove of little value.

Apart from their value for testing and demonstration purposes, all these Stations are proving a useful source for the supply of good seed. From Talang 1,600 gantangs of pure strain padi were sent to Ulu Selama. From Pekan Darat 2,425 gantangs of Radin 7 were sent to the Dindings, and to Lower Perak and Ulu Langat districts to supply seed in places where floods had totally destroyed the crop. Seed of Serendah strains from Malacca, to the amount of 102 gantangs, was also sent to Ulu Langat District. The pure strain padi from the Dong Station was distributed for trial in various parts of Western Pahang.

The plots at Kamunting for testing the effect of green manures to improve reslimed mining land were maintained and extended. The best plants have proved to be *Tephrosia candida* and *Mimosa invisa*. *Crotalaria anagyroides* is also doing fairly well, but *C. usaramoensis* has succumbed to root disease and appears to require better drainage than is practicable, or desirable, on a large scale on such land. The extended area has been divided into plots containing different green manure plants. After two or three more seasons under these plants the plots will be planted with padi to test their effect in improving the soil.

2. Pests.

Sogata pallescens. Dist. This Fulgorid leaf hopper appeared, as reported last year, in enormous numbers on padi in Penang, the Province, Krian, Larut and Matang and some localities in Southern Perak. It was most numerous on younger padi that had been damaged by deep water and accentuated the harm so caused. Though it was the most notable pest of the 1925—26 season, it disappeared, in dry weather during the first 2 weeks of January, quite as suddenly as it had first appeared. It was difficult to decide to what extent the damage observed was really attributable to deep water, and to what extent this insect was responsible for it.

Padi Fly.—(*Leptocorisa* spp. mainly *acuta* Thunb.) Owing to the control measures taken these insects did but little damage to padi in Kuala Pilah district early in the year. At the end of the year they were found fairly gene-

rally on ripening padi in all the States and did some damage in certain localities in Selangor. They appear to have been increasing in numbers during recent seasons.

Stem borers.—Various species of these caterpillars have done some damage. They were fairly numerous on the 1925—26 crop in Province Wellesley and on the 1926—27 crop in parts of Selangor.

Nymphula depunctalis Guen.—This Pyralid moth was prevalent on nurseries in parts of Malacca and did considerable damage to the young plants. At the Pulau Gadong Experiment Station, the nurseries had to be drained, sprayed and stimulated with artificial fertilisers to control the pest and overcome its effects.

Other pests recorded as doing damage were.—Mole crickets, *Curtilla africana* Beauv., M. Sa—sorok, along the river in Lower Perak district where dry padi was planted; and *Scotinophora coarctata* F, the Pentatomid known to Malays as Kutu bruang or Bena kura, which did damage in Pahang, being the principal pest of padi in Pekan and Kuantan districts.

Rats as usual did serious damage in many places during the harvest, early in the year. At the end of the year, however, they were present everywhere in quite unusually large numbers and did much damage to padi, especially while the water was deep. Their ravages have been so harmful that the extension to other States and Settlements of the special control measures employed in Krian is under consideration.

Rat Campaign, Krian.

This campaign, inaugurated in 1924, proved sufficiently successful to warrant its continuance throughout 1925 and 1926. But for the continuous systematic and intensive trapping in Krian, it is certain that the damage to the 1926—27 crop there would have been serious, since rats were very numerous in all parts of the country. As it was, some damage was done, more especially along the Province Wellesley boundary at the end of the year, the rats apparently having been brought in on flood water. The following table shows the number of rats destroyed.

	From Commencement, November 1924, to end of 1925.	1926.
Cultivators	... 281,033	238,041
Schools	... 268,638	362,020
P.W.D. Coolies	... 112,123	73,041
Total	... 661,794	673,102
Less 1924 figures	... 9,931	
Total 1925	... 651,863	

There were thus 34,239 more rats destroyed in 1926 than in 1925.

Minor Crops.

Pineapples. In Johore seven pineapple canning factories were in operation during the year compared with six in the previous year. The factories in Singapore and that at Klang continued in operation.

Plantings of this crop were fairly extensive in Johore during the year and there are many good areas that should soon be in full bearing. The problem of obtaining land for this crop in the neighbourhood of existing factories is, however, likely to become more difficult from year to year, since pineapples are almost always grown as a catch crop under young rubber.

An important step taken during the year has been the formation of the local Producers Combine with the object of improving the quality and uniformity of the tinned fruit and, as a consequence, obtaining a better price for it. The Combine has already succeeded in limiting consignments to "No. 1 Grade" and "Good average quality," the inferior grades being no longer packed.

The Department has under consideration the best means of giving effect to the suggestions put forward by the Imperial Economic Committee in connection with the pineapple industry. In this the Field Division is assisting the Agricultural Economist.

Oil Palm.—The cultivation of this crop continues to attract attention and the planted area is being steadily extended. The Field Division has assisted the Agricultural Economist to collect full information regarding the areas under this cultivation in the different States.

Officers of the Field Division have examined certain areas of land in Negri Sembilan, Pahang and Johore and have reported on their probable suitability for Oil Palms. Samples of soil from such areas have, when necessary, been collected and sent to the Chemical Division for analysis. In Johore the question of earmarking a definite area for this crop has been considered and a considerable tract of country has been provisionally suggested for this purpose. There is very little suitable land left in the western States of the Federation, with the exception of one or two areas in Negri Sembilan, but there are still extensive areas in Pahang.

Tapioca.—In Johore the production of Tapioca was slightly less than that of the previous year, owing mainly to the fact that large areas of this catch crop were removed in

the Muar district towards the end of 1925. Large additional areas have, however, been opened up in the Segamat and Central Johore districts during the year and about twenty-four factories have been in operation.

Areca Palm.—The export of nuts from Johore amounted to 216,000 pikuls an increase of almost 30,000 pikuls on that of 1925. Younger plantations around Batu Pahat, Benut and Pontian are showing good growth.

Tuba.—There are about 470 acres of this crop in Perak South, of which 379 acres are in Kinta district. In Johore there has been an extension of the planted area, mainly on the Japanese estates in the Johore River district. There have also been other enquiries about this crop in Johore and it is possible that 1,000 acres of it will be planted on a European owned estate in the near future.

Cloves.—Young clove bushes are being planted in existing gardens and several new gardens are being established in Balik Pulau district of Penang. Damage by Cerambycid borers continues. Shortage of staff prevented that use being made of the successful results of preliminary experiments for their control, which it was hoped might be made during the year and which was referred to in last year's report. Encouragement and advice have been given to cultivators at Balik Pulau to cut out and destroy the Loranthus which was found attacking trees in nearly every clove garden.

Miscellaneous Pests and Diseases.

The Giant Snail (*Achatina fulica* Fr.).—An article giving the available information concerning this snail was published in the *Malayan Agricultural Journal* Vol. XIV, p. 231, July 1927. Since this was written the snails have appeared again in considerable numbers at Butterworth and are now becoming fairly well distributed throughout Province Wellesley. They were also found around Kulim town in South Kedah in October. A report of their presence on Maxwell's Hill, Taiping, was not confirmed.

Water Hyacinth (*Eichhornia crassipes*).—As mentioned in my last report, further work was needed to destroy large accumulations of the weed in tributaries of the Perak River. This work was commenced in the Sungei Lumut on the 25th February and by May 11th all the weed in this river had been destroyed and traps had been erected to prevent, as far as possible, the re-entry of floating plants from the Perak river. One bank of the main river was then cleared up stream to Ayer Mati in Bota Mukim. The gang of coolies commenced to clear the Ayer Mati itself on June 14th and finished this work on the 26th September. The gang was then transferred to Krian, where it cleared the Sungei Gedong and was working on the Sungei Briah at the end of the year. The Sungei Dadap in Lower Perak was cleared on contract by arrangement with the Executive Engineer.

It was intended to recruit a second gang for work on the Perak River whilst the original gang was engaged at Ayer Mati, but suitable coolies for this purpose could not be obtained.

The provision of a vote for the destruction of this weed on Crown Lands enabled work to be commenced in Province Wellesley during the year. It was found that small streams forming the sources of the Prai river were full of the weed and operations were commenced in one of these streams. Progress was somewhat slow, as the banks of the stream were so low that the weed had often to be carried a considerable distance to a dry spot where it could safely be left to decay without fear of its further growth.

Patches of this weed in Ulu Selangor district in Selangor, in the Muar river in Kuala Pilah district and in Port Dickson district in Negri Sembilan, and in various places in Malacca have been destroyed. Work on the Sungei Sembrong in Johore was undertaken by the Public Works Department.

Mistletoe.—Various species of these parasites are still commonly to be met with everywhere on fruit trees, kapok, cloves, nutmegs and ornamental trees. They are perhaps most in evidence in native holdings all over Pahang. Action has been taken everywhere to have these plants destroyed and some improvement has been effected, but there is still much to be done, especially as reinfection occurs rapidly on cultivated land near jungle.

Instruction.

School Gardens.—On the whole good progress has been made with school gardens everywhere, except perhaps in Pahang where seed supplies have been insufficient and, though the land has been kept in good order, it is often found that few plants are actually being grown. In most places both teachers and pupils evince a keen interest in their gardens, which is stimulated when arrangements can be made for competition between schools at local Agriculture Shows. In Negri Sembilan some of the pupils grow vegetables in their own kampongs.

The Department has provided supplies of tools, manure, lime and planting materials; in particular, good imported varieties of Maize (sweet corn), Ground nuts, Sweet Potatoes and Tapioca, grown successfully at the Government Experimental Plantation, Serdang, have been distributed to all Schools with gardens. The sweet corn and sweet potatoes are reported to be very popular in Negri Sembilan.

Agricultural Shows.—The Malayan Agri-Horticultural Association held its Annual Exhibition in Kuala Lumpur from the 27th to the 30th August, 1926. Shows were also

held at Malacca on June 26th and 27th, Seremban on the 10th July. and Taiping on the 14th and 15th August. In addition there were five District Shows during the year. In many cases there was a reduction in the quantity, but an improvement in the quality, of exhibits. The poultry section was on the whole not so strongly supported as in previous years, notably at Seremban. Officers of the Field Division assisted at all these Shows. Departmental Exhibits were staged in Kuala Lumpur, Malacca, Taiping and Teluk Anson.

Lectures.—The Chief Agricultural Field Officer read a paper on "Agricultural Liaison in Malaya" before the Planters Conference held under the auspices of the Incorporated Society of Planters in Kuala Lumpur from June 17th to 19th. He also read a paper on "Some Diseases of Renewing Bark" before the Rantau and Port Dickson Branch of the same Society on July 26th.

Publications. The following papers by Officers of the Field Divison have been published in the *Malayan Agricultural Journal*, Vol. XIV during the year.

"The Giant Snail (Achatina fulica) in Malaya" by F. W. South.

"Trials of Selected Padi Seed in Perak North" by F. Birkinshaw.

"A Brief Summary of Tapioca Cultivation on What is now a Valuable Rubber Estate in Province Wellesley" by F. Birkinshaw.

General.

A draft was prepared of a revision of the Agricultural Pests Enactment, to which there were already five Amendment Enactments, so that these Amendments and certain others found necessary from practical experience, could all be included in one revised Enactment. The proposed revised Enactment was under consideration by the Federal Council at the end of the year.

A number of consignments of planting material for export, almost all from the Government Experimental Plantation Serdang, were inspected for their freedom from pests and diseases prior to despatch.

Annual Report of the Mycologist for 1926.

Staff.

Mr. F. S. Ward was appointed an Assistant Mycologist and reported for duty on 16.1.26. Mr. A. Thompson, 1st Assistant Mycologist proceeded on long leave on March 12th, 1926 returning and reporting for duty on November 15th, 1926. During the year good work was done by Raja Abdul Rahman, Junior Agricultural Assistant attached to the Mycologist and Che' Idris, Laboratory Attendant.

Rubber.

During the year the Rubber Research Institute of Malaya came into existence, and about the beginning of November most of the routine work appertaining to Rubber, formerly carried out by this division, was being carried out by the Rubber Research Institute.

Work on control of Wet-Rot of rubber roots caused by Fomes pseudo ferreus (Wakef).

In the Annual Report for 1925 this subject was given some prominence. The control work was carried on intermittently during 1926. At the present time, few cases of the disease are to be found on the estate where the work was done.

The figures given last year which cover 5 months work were:—

No. of trees opened up.	No. of badly diseased trees cut out.	No. of trees found with laterals slightly infected.
753.	212.	185.

The final totals over 10 months, which cover a further five months' working period, are:—

No. of trees opened up.	No. of badly diseased trees cut out.	No. of trees found with laterals slightly infected.
1400.	371.	414.

Over the whole period, approximately 30 per cent of the total number of trees opened up were found in such a condition that they could be treated successfully by the excision of slightly infected lateral roots. In some months, 50% of the trees opened up were found with slightly infected lateral roots. Evidently, the costs depend largely on the type of labour employed. During the first few months, with Chinese labour, the cost worked out at about $3/- per tree opened up;

during the last month, October 1926, with Tamil labour, the cost is given at 65 cents per tree opened up. The final report will be written up as soon as possible but it would be advisable to emphasise what has been written previously—"that this method of treatment is only likely to be economically sound if the disease is tackled when it first appears—on trees about 12 years of age."

Sun-Scorch of Lateral Roots of Hevea brasiliensis.

The Annual Report for 1925 described a "Secondary Leaf-Fall". The primary initiating cause was ascribed to the atmospheric conditions prevailing during the wintering period of 1924-25. Again, in 1925-26, the wintering period was abnormal, with a prolonged, dry period with scorching sun. The trees were leafless for a long period.

Towards the end of April reports were received from several estates of unexpected symptoms of some disease on exposed lateral roots. On the affected roots, slight cracks appeared in the bark, which on further examination, showed a much greater extension of apparently scorched and dead, dry bark than the cracks on the exterior indicated. The wood beneath the dead bark showed the usual "Diplodia" discoloration, and this fungus was isolated from the diseased tissue.

The evidence, leading to the conclusion that the roots had been scorched by the sun during the prolonged, hot, dry, wintering period has already been presented, (6) and (7). The work done since April has fully substantiated this conclusion. A course of treatment was prescribed as a measure of safety. This was quite successful, no further requests for aid were received.

Diplodia sp. and Die-back.

The above work led to inoculations being carried out with the Diplodia sp. isolated from the roots. The interesting conclusion was reached, that the Diplodia sp. associated with rubber tree affections, such as "Die-back", "Lightning-strike", Sun-scorch of exposed lateral roots", is not an ordinary wound parasite as is commonly believed, but it is a somewhat specialised form of wound parasite, which, under certain conditions allowing for sufficient heating of localised areas of cortical tissue, can produce a strong infection and the fungus can make rapid headway in the woody tissue of *Hevea brasiliensis*. This conclusion resulted in an enquiry as to the fungus or fungi responsible for bad attacks of "Die-back" on impoverished soils; this form of "Die-back" is a serious matter on many hilly estates in Malaya. One hundred and five branches of *Hevea brasiliensis* suffering from "Die-back", gathered from a typical hilly area where no pre-

cautions had ever been taken to prevent "wash", were split open with the following result:—

(1)	Typical Diplodia	- 11 cases.
(2)	Diplodia with other fungi or insects	- 22 cases.
(3)	No Diplodia present	- 72 cases.

From these results it would appear that fungi other than the "Diplodia" sp. commonly assumed to be mainly responsible for "Die-back" of rubber branches, must be considered of major importance in connection with this problem. One of the commonest fungi found associated with this affection is *Polystictus hirsutus* Fr. Pure cultures of this species were obtained and inoculation experiments carried out; all proved negative.

Collar Patch Canker.

A type of Patch Canker in Malaya has been shown to be caused by a fungus which is different to the one which is the cause in other rubber growing countries i.e. *Phytophthora faberi* (Maubl) (The Assistant Mycologist, (Mr. A. Thompson) reports that he has also isolated *Phytophthora faberi* (Maubl) from specimens of Patch Canker found in Malaya). Petch in his latest book on diseases of Hevea brasiliensis gives a warning regarding affections of Patch Canker at the collar; this form of the disease is considered to be by far the most serious. An interesting case in this connection came under notice during the year. A number of trees on one estate were suffering from attacks of Patch Canker in the recently tapped bark and an attempt was made to treat the trees by scrapping away the diseased tissue. Within six months' time the first cases of Collar Patch Canker were recorded for Malaya from the same estate. Small portions of the scrapped tissue had evidently escaped detection and found their way to the collar, thereby starting a new infection at the base of the trees. The scraping away of diseased tissue obviously seems unsound, so advice was given to obtain broad chisels and cut the attacked cortex out in large pieces which would not escape detection easily. Since this advice was adopted, there have been no further reports of fresh cases of "Collar Patch Canker".

Branch Ustulina.

Ustulina Maxima (Web) Von Wettstein=(*U. zonata Ler.* Sacc) is well known as a root disease of old rubber trees. Many years ago it was proved conclusively that this fungus can attack any part of the tree, if a convenient point of entry is provided. On many coast estates, managers report that the above-mentioned fungus is responsible for heavy losses, as it finds easy access through broken branches and then grows into the stem of the tree. Owing to pressure of other

work no time could be given to devise remedies for this particular problem, but it is evident that these cases should be followed up as quickly as time will allow.

Other work on rubber, noted during the year, was a vigorous attack on seedling leaves by *Helminthosporium Heveæ* (Petch). An interesting case of a bad attack of *Fomes lignosus* (Kl.) on young rubber was noted in which the old stumps of Kempas (*Koompassia malaccaensis*) were the main sources from which the original attack commenced. These old stumps of Kempas were riddled with the mycelium, and the external, white mycelial strands of the fungus could be gathered in large quantities by kicking away the top layer of soil in the vicinity of these stumps. The usual method of holding up the spread by means of trenches would have been very expensive and probably of little utility, so advice to proceed on other lines was given. It is hoped to put in a later report as to the measure of success resulting from the treatment recommended.

Brown Bast.

With regard to other rubber diseases there is little which calls for comment. Brown Bast has been recorded from a few estates, chiefly those engaged in periodical tapping, i.e. four months' daily tapping alternating with four months' rest. Estates using the alternate daily tapping system are seldom troubled with Brown Bast, and lower outputs owing to restriction tend towards a further decrease in numbers of Brown Bast cases.

Black Stripe and Mouldy Rot.

Black Stripe and Mouldy Rot are kept in control by the routine methods recommended by the Department and no new work has been done in connection with these diseases.

Coconut Palm Diseases.

While a certain amount of rubber work was undertaken, most of the time during the year was spent in trying to obtain evidence which would clear up the position in relation to Coconut Palm diseases. Much progress can be reported and the broad facts seem fairly clear. A great amount of work remains to be done, however, before the work will be fully established.

Bud-Rot.

One of the classical epidemic diseases is that known as "Bud-Rot" of Coconut Palms. A similar disease resulting in the rotting of the bud tissues has been found in Areca palms, Palmyra palms and African Oil Palms. This rotting of the bud tissues would probably become a feature in any palm cultivation taken up on a commercial scale, whatever the species.

The causal fungus of true "Bud-Rot" has been determined as *Phytophthora palmivora* (Butl.) in both the Eastern and Western Tropics.

The rotting of the bud tissue is no proof that *P. palmivora* is present in the rotting tissues for this rotting of the bud tissues is the usual culminating point in any affection which leads to a gradual lowering of disease resistance of the palms. In Coconut plantations in Malaya several phenomena have been noted which end in the rotting of the bud tissues, but careful work has substantiated the view that the so-called "Bud-Rot" in Malayan plantations could always be placed in a different category than the "Bud-Rot" caused by *P. palmivora*. At first, the above mentioned phenomena were very involved, but recent work indicates that a successful ending to the investigations may be anticipated.

In every case of so-called "Bud-Rot" one or two or three peculiarities may be involved. Groups of trees with rotted bud-tissues are common on most coconut plantations at some time or other and now are usually put down to "Lightning-strike." Examination of such groups of trees often showed:—

(a) A soft salmon-pink discoloration of the stem.

(b) A hard lignification of all tissues of the stem with the vascular bundles showing up prominently because of marked brownish red discoloration.

(c) A mixture of (a) and (b); in some cases a hard central portion is surrounded by the soft salmon-pink tissue, in others the reverse is the case.

Lightning Strike.

To regard "Lightning Strike" as the cause of all the trouble on Malayan coconut plantions was no more progressive than to regard all Bud-Rot symptoms in Malaya as being caused by *P. palmivora*. Lightning-strike in poorly developed areas is usually accompanied by either the (a) or (b) symptoms, but a recent examination of this type of injury in a well-developed field with trees giving magnificent crops of nuts showed no trace of either (a) or (b) symptoms, and an examination of the roots showed these to be healthy. Thus, lightning-strike can be clearly accepted as a cause which produces symptoms, in which rotting of the bud-tissues is a prominent feature, if the trees affected are left standing for any length of time. The number of trees lost through "Lightning-Strike" must be fairly large and an attempt will be made to gather definite information on this point.

Lignification of the stem.

Up till recently, the position was unsatisfactory with regard to (a) and (b) symptoms. A fair amount of information was obtained with regard to (b) symptoms as a result of work undertaken in a field of coconuts in which the trees were obviously deficient in vitality. Old trees, showing varying stages in this typical deficiency disease, were examined while standing and were cut down later. The cortex and external woody tissues seemed quite healthy and only in one out of four cases could the typically discolored vascular bundles be definitely made out in the stem tissues. In this particular case the discolored vascular bundles showed up prominently for a distance of eight feet from the ground. All the trees cut down were still living and had healthy bud tissue.

The discolored vascular bundles could not be seen in the stem tissues in three of the felled trees. While cutting up the roots, however, a glancing blow of the axe opened up a small area on one tree just at a place where the roots enter the stem, and revealed one part with discolored vascular bundles; these were followed down to their root connections and those roots were spilt open. No definite discoloration or sign of disease could be observed macroscopically in these roots, when compared with roots from healthy, good yielding trees in other areas. The great difficulty in laboratory examination has been the extreme lignification of all the stem tissues, which made examination by sections a matter of great difficulty. The roots connected with the discolored vascular bundles at the base of the stem provided better material for sectioning, and very fine, thin hyphae were demonstrated in the large vessels of the vascular bundles. Further work to isolate the fungus will be necessary, but it seems practically certain that the trees are attacked by a fungus which is the cause of a slow root disease; this fungus progressively attacks the water carrying vessels and as the water supply is reduced the leaves become smaller and smaller and finally a limit is reached when the trees succumb owing to lack of sufficient water.

The other trees cut down at the same time showed similar appearances at the very base of the stem where the root tissue joins together to form the stem. Further work is to be carried out in this area.

Soft salmon-pink Discoloration of Stem tissues.

In connection with this particular disease, it can be stated that these symptoms can be found quite apart from the "lignification" symptoms, so it seems reasonable to suggest that two different diseases have to be dealt with. Sections of diseased stems have been worked over in the laboratory and have proved to be practically pure cultures of *Polyporus ostreiformis* (Berk). The fructifications of this fungus have been developing continuously for six months in the laboratory and

many interesting observations, which are not suitable for an annual report, have been made. Pure cultures were established and inoculations are now under way.

Marasmius sp. on Coconut palms.

In the Annual Report for 1924 a *Marasmius* sp. causing a disease of fruit bunches of Oil Palms was mentioned. This fungus has recently been found doing damage to two year old Coconut Palms. The bases of the affected palms are rotted away to a black fibrous mass, and the death of the palm results. This fungus was sent home for identification but none has yet been received.

Nut-Fall of Coconuts.

Some interesting cases of "Nut-fall" have been recorded during the year, but no time could be given to the problems involved. Once the more important coconut diseases have been dealt with fully, "Nut-Fall" will require attention.

African Oil Palm.

The usual diseases, "Crown disease" "Bud-Rot" etc. have been met with but could not be dealt with. Two interesting cases of diseased fruit bunches have been noted for future attention.

Experiments to compare the yields of artificially and naturally pollinated young palms resulted in yields much in favour of artificial pollination. Diseased bunches of fruit were found later on the artificially pollinated palms, the pericarp of the individual fruits becoming very soft and slimy. Up-to-date, this particular type of diseased fruit has not been found on naturally pollinated palms.

The other affection of the fruit-bunches is the hardening up of the individual fruits; then they are detached from the bunches only with difficulty. This hardening-up seems to be a form of premature ripening; the affected fruits are said to be useless for oil production.

Miscellaneous.

Many specimens have been received from the Forestry Office. Seedlings of Berus, specimens of Chengal timber and a fungus attacking stored keruing wood have been under observation. Determination of the fungi attacking the roots of Gutta Taban trees (*Palaquium oblongifolium* Burck) and two distinct sets of symptoms recorded. On one specimen the external white mycelial strands of *Fomes lignosus* (Kl.) could not be mistaken, while the more serious disease on old trees is a "Wet-Rot" closely simulating the appearance of "Wet-Root Rot" of rubber caused by *Fomes pseudo-ferreus*

(Wakef.). Pink Disease (*Corticium salmonicolor* B and Br) has also been identified as a parasite on branches of Gutta Taban. Two interesting visits were made in respect to disease in Gutta Taban cultivations.

A visit to an estate endeavouring to establish the cultivation of the Piqui-a nut (*Caryocar villosum*) showed the presence of several types of root disease.

Cultural work and inoculation experiments with fungi associated with diseases of Lime trees (Citrus sp.) and Lemon grass (*Cymbopogon citratus*) have been carried out by the Assistant Mycologist.

Specimens of Avocado Pear (*Persea aratissima* and Cashew Nut (*Anacardium occidentale*) have been examined and reported on.

Some work has been done in relation to attacks of *Sclerotium Rolfsii* (Sacc) on Tapioca (*Manihot utilissima*) and Jerusalem artichoke (*Helianthus tuberosus*).

Mr. A. Thompson, 1st Assistant Mycologist, spent some weeks working at the Imperial Bureau of Mycology on *Phytophthora* sp. which had been isolated from various plants in Malaya.

The following articles were published by the Division in the Malayan Agricultural Journal for 1926.

(1)	A disease of the Betel Vine caused by a species of Phytophthora. M. A.J., Vol. XIV, No. 1 ...	By A. Thompson.
(2)	Treatment of Wet-Root Rot in Malaya, M.A.J., Vol. XIV, No. 2	By A. Sharples.
(3)	Diseases of Coconut Palms, M.A.J., Vol. XIV, No. 3 ...	do
(4)	Hevea Mildew in Ceylon and Malaya, M.A.J., Vol. XIV, No. 4 ...	do
(5)	Diseases of the Coconut Palm (contd.) Vol. XIV, No. 4 ...	do
(6)	"Sun-Scorch" of exposed lateral roots of *Hevea brasiliensis*, M.A. J., Vol. XIV, No. 5 ...	do
(7)	Inoculation Experiments in relation to "Sun-Scorch" of exposed lateral roots of *Hevea brasiliensis* M.A.J. Vol. XIV, No. 9	By F. S. Ward.

Bulletin Statement 1926.

During the year there has been a gratifying increase of interest in the Malayan Agricultural Journal. The most satisfactory feature is the increase in number of local subscribers, an increase of 42, representing a percentage increase of 46. Total increase in subscribers is 55, representing a percentage increase of 38. The increase in revenue, as compared with 1925, is $1013-47 or a percentage increase of 82.

One special bulletin No. 38, was issued during the year.

A tabulated list is given below as to the present statistical position:—

Publications.

The Malayan Agricultural Journal Volume XIV. Special Bulletin No. 38 "A Preliminary List of Food Plants of some Malayan Insects."

Finance.

Expenditure on publications	...	$6,664.54
Revenue from publications	...	2,246.89

Distribution of Publications (M.A.J.).

December 1925.	Subscribers.	Free List (Officials & Others)	Exchangers.
Local	92	133	17
Foreign	53	34	208
Total	145	167	225
	Grand Total ...	537	
December 1926.			
Local	134	140	17
Foreign	66	40	219
Total	200	180	236
	Grand Total ...	616	

Library Statement.

The work of the library has gone smoothly throughout the year. Much binding still requires to be done.

Mr. L. A. J. Rijk, has spent much time in translating articles for officers of the Department.

Annual Report of the Economic Botanist for 1926.

Staff.

Dr. H. W. Jack returned from long leave on 24th May, and on 26th September proceeded to Japan on duty as a Delegate from Malaya to the Third Pacific Science Congress and returned on 2nd December. During Dr. Jack's absence on leave and on duty, Mr. W. N. Sands, Assistant Economic Botanist, acted as Economic Botanist.

The death on 28th June of Inche Din, Junior Agricultural Assistant, who was stationed at Parit Buntar in charge of field work on padi is recorded with regret.

Padi.

The excellent weather experienced in Krian during the padi harvest and the extensive use of selected seed did much to counterbalance the damage done earlier by heavy floods and consequent insect pests, so that 14,000,000 gantangs of padi were harvested, or approximately the average for the District. Padi commanded high prices, ranging from 16-18 cents per gantang, so that cultivators had a good season.

In Krian, after harvest, 5,350 gantangs of selected seed were purchased from growers and this quantity together with 5,894 gantangs obtained from the Titi Serong Experiment Station were distributed to growers as under:—

(a) *In Krian District.*

Seraup Kechil	No. 36	...	1,749	gantangs.
,, ,,	48	...	214	,,
,, ,,	68	...	300	,,
,, ,,	52	...	82	,,
,, ,,	257	...	355	,,
,, ,,	20	...	338	,,
,, ,,	371	...	50	,,
Seraup Besar	15	...	752	,,
Radin	7	...	556	,,
,,	4	...	261	,,
,,	16	...	200	,,
,,	2	...	308	,,
	Total	...	5,165	,,

(b) *In Other Parts of Malaya.*

Seraup Kechil No.	36	...	490 gantangs.
,, ,,	48	...	9 ,,
,, ,,	52	...	44 ,,
Seraup Besar	15	...	66 ,,
Radin	2	...	850 ,,
,,	4	...	1,006 ,,
,,	4	...	3,100 ,,
,,	13	...	285 ,,
Padi Pahit	1	...	229 ,,
	Total	...	6,079 ,,
	Total distribution	...	11,244 gantangs.

Pure line selection work was continued at Titi Serong in the present season with 28 strains, and 143 strains were maintained as Foundation Stocks.

The Pure Lines which were again subjected to yield tests comprised the following 26 selections:—

12 strains of Seraup Kechil.
7 strains of Radin
2 strains of Seraup Besar
1 strain of Machang
4 strains of Serendah.

Most of these lines have now been tested over a period of not less than five years and have been grown on a large scale in Krian and other districts where they have maintained their high yielding characters. The most popular strains amongst growers are Seraup Kechil Nos. 36 and 48; Radin Nos. 7, 13 and 2; Seraup Besar No. 15; Padi Pahit No. 1; and large acreages in Krian and other parts of the Peninsula are planted annually with these strains of padi which frequently win prizes at Agricultural Shows.

In order to provide supplies of selected seed-padi for distribution, large increase plots of seventeen of the Pure Lines were grown and from these about 6,000 gantangs of padi were obtained.

The manurial and cultivation experiments were continued along the same lines, on the same plots, and with the same pure strain (Seraup Kechil No. 36). Whilst no conclusions can safely be drawn from three seasons' results, yet the better growth and increased yield of plots which were given simple cultivation or received an application of a phosphatic manure appear to indicate that, under Krian conditions, better crops may be obtained by inexpensive cultural methods and the use of a phosphatic fertilizer. On the other hand, the plots from which straw, grass and weeds were removed or burnt, show decreased yields of grain.

At the Pulau Gadong Experiment Station in Malacca the selection, isolation and testing in pure lines of strains of the local varieties known as Nachin Puteh and Padi Siam was continued. The results were promising, notwithstanding an adverse season and the attacks of pests. No pure lines of exceptional merit can yet be safely recommended for extended trial as the yield results last season have been undoubtedly masked by conditions unfavourable to successful growth; still in course of time, improved strains of padi suitable for conditions in Malacca will certainly be obtained.

Again, owing to flood water and the attacks of rats and insects, the test plots of selected Padi Siam and Radin No. 13 and the manurial and cultivation experiments gave much lower yields and it was not possible to draw any reliable conclusions from the season's results.

The results obtained at the Pekan Darat Experiment Station in Province Wellesley last season were similarly disappointing. Here the variety, cultural and manurial experiments were adversely affected by drought early in the season, flood water in December, followed again by dry conditions before the plants had finished flowering. As a result the ripening of the grain was irregular, the straw was weak and the subsequent yield of grain rather low.

Both here and in Malacca the investigations which are in progress should in a few years enable most valuable information and results to be obtained.

A plan of an experimental rice store was drawn up in collaboration with the Public Works Department, and a scheme of rice storage experiments will be put in operation as soon as the store is completed, probably early in 1927. This work is deemed necessary and should prove valuable as a means of safeguarding supplies of rice in times of shortage.

The usual statistics regarding the area under rice and the yields obtained in each district were collected from District Officers and others, and the following summary was compiled:—

SUMMARY OF PADI RETURNS—BRITISH MALAYA.
SEASON 1925—26.

State or Settlement.	WET		DRY	
	Acreage	Yield	Acreage	Yield
	FEDERATED MALAY STATES.			
Perak ...	89,923	20,514,904	3,518	444,994
Selangor ...	15,745	2,867,576	4,783	669,677
Negri Sembilan ...	31,305	3,982,262	15	300
Pahang ...	26,147	4,003,620	2,826	404,801
Total F.M.S. ...	163,120	31,368,362	11,142	1,519,772
Krian ...	54,669	14,092,629	55	4,400
	STRAITS SETTLEMENTS.			
Singapore ...	—	—	—	—
Penang ..	5,060	1,025,5	—	—
Malacca ...	27,061	11,666,2	—	—
Province Wellesley	39,390	7,478,0	—	—
Dindings + ...	400	40,0	330	33,000
Total S.S. ...	71,911	20,209,720	330	33,000
	UNFEDERATED MALAY STATES.			
Johore ...	3,866	384,1	1,462	126,524
Kedah ..	162,432	32,120,7	3,635	659,106
Perlis ...	65,139	9,005.6	300	42,080
Kelantan *f* ...	109,247	19,150,0	61,313	7,175,000
Trengganu ..	8,000	1,200,0	4,000	500,000
Total U.M.S. ...	348,684	61,860,507	70,710	8,502,710
	SUMMARY—F.M.S., S.S., & U.M.S.			
Total F.M.S. ...	163,120	31,368,362	11,142	1,519,772
Total S.S. ...	71,911	20,209,720	330	33,000
Total U.M.S. ...	348,684	61,860,507	70,710	8,502,710
Grand Total Malaya	583,715	113,438,589	82,182	10,055,482

+ Figures for season 1924-25 given as figures for season 1925-26. Last season's have not yet come to hand.

f. Approximate estimate only since part of the records were destroyed by fire.

Coconuts.

Monthly records of individual palm yields on 530 palms on two estates were maintained for the sixth year. These records are useful as supplying the only available data on coconut cultivation in Malaya and show interesting and wide variation in palms growing under uniform conditions.

Good progress is being made at the Coconut Selection Experiment Station near Klang. Plantings are now almost completed and growth is good. The setback caused by the floods in November 1925 has disappeared, and during the very severe floods of December of this year, the drainage, aided by mounding, proved excellent so that no flooding was seen and no damage resulted. A cover of *Calapogonium mucunoides* is now fairly well established, and is proving useful in checking weeds and in enriching the soil. Labour was difficult to obtain early in the year but plenty of coolies are now available. The plantings include 85 lots of 25 palms each selected as heavy crop producers, and 35 lots representing different types in Malaya.

The Chemical Division is investigating the variation in oil content of the copra derived from nuts of palms selected for heavy copra production.

Records of the flowering and fruiting characters of races of dwarf palms growing in the Parit Buntar Office compound, inaugurated in 1925 were maintained and over 300 seednuts were dispatched to Klang, Taiping and Malacca from these palms which are now bearing very freely. There is a big demand for seednuts from these palms locally, though they are in no way to be considered as selected except as useful types.

There has been little change in the area under coconuts in Malaya in the past year, though a slight increase (perhaps 2%) on 1924 figures, is probable.

At the Malayan Agricultural Show at Kuala Lumpur and also at the Agricultural Show at Teluk Anson, a collection of coconuts from individual palms grown at Carey Island and at Batu Kawan showing the great variation in yield of nuts and of copra per palm, was exhibited. The variation exhibited was based on records covering a period of six years. An exhibit of the three chief commercial races of dwarf coconut was also made.

Betel Nuts.

A comprehensive collection of the local varieties of the palm producing these nuts was made and seeds were sown in nurseries at the Coconut Selection Experiment Station, Klang. The collection embraces 17 different local varieties

and germination has been satisfactory. Some thirty palms of each variety will be planted.

A collection of the different local varieties and of dried samples received from India, Ceylon, Burma, Borneo, Java and Sumatra were exhibited at the local Agricultural Show, together with a series of photographs illustrative of planting methods.

The results of investigations concerning the life history of the betel-nut palm, the different local and foreign varieties, and the various characters of local and foreign commercial samples, were published in the Malayan Agricultural Journal.

Soya Bean.

Seeds of varieties of this valuable bean which were collected from Burma, Siam and local sources and sown in Kuala Lumpur nurseries, gave promising results, and a number of excellent types were selected for further trials as bean producers under local conditions.

Maize.

A collection of the best local types of maize was made and sown in 300 plant plots in Kuala Lumpur for selection and breeding purposes. A number of selected plants of each of the five types collected were carefully self-pollinated and satisfactorily harvested. These will form the basis for continued inbreeding, hybridization and selection along approved lines.

Cotton.

Seeds of several strains of Sea Island and Egyptian cottons which had been preserved as pure lines from previous seasons were sown in the nurseries in Kuala Lumpur and gave good growth and satisfactory crops.

Oil Palm.

Preliminary observations were made with a view to a study of variation in the oil palm and more attention will be focused on this promising crop when mature palms growing under estate conditions are available for examination.

Ground Nuts.

Local types of ground nut were sown in Kuala Lumpur nurseries with a view to selection of heavy nut bearing strains, but damage by rats and later by continuous rains made selection inadvisable; however, a number of types have been selected provisionally for further trials under rat proof conditions next year.

Herbarium and Identification of Plants.

The small reference herbarium was kept in good order and numerous specimens of economic and other plants were collected and added to it. The herbarium was freely used by the Agricultural Instruction Division in the courses of training of Malay Apprentices. As in previous years a large number of plants were identified for other Divisions and for estates.

Publications.

The following papers and articles prepared by Officers of this Division were published in the Malayan Agricultural Journal during the year:—

(a) Epiphytes on Cultivated Trees ... By W. N. Sands.

(b) Further Notes on the Brazil Nut Tree in Malaya ... By W. N. Sands.

(c) Observations on the Betel Nut Palm (Areca Catechu, L.) and Betel Nuts ... By W. N. Sands.

(d) A paper on "Pure Line Selection with Rice" was read by Dr. H. W. Jack at the Third Pacific Science Congress in Tokio..

Annual Report of the Government Entomologist for 1926.

Staff.

Mr. B. A. R. Gater, Assistant Entomologist, having been appointed to the post of Malaria Research Officer, left this Department, on the 31st. October, after nearly 4 years' service.

Publications.

During the year, attention has been especially paid to writing up the results of previous investigations.

The following publications have been published:—

Bulletin No. 38, "A Preliminary List of Food-plants of some Malayan Insects from the records obtained in the Entomological Laboratory from 1920—1926."

"Annual Report of the Entomological Division for 1925," M.A.J., Vol. XIV, No. 6.

"Miscellaneous Insects of 1925." M.A.J., Vol. XIV, No. 8.

"Further observations on the Malaysian Coconut Zygaenid, (*Artona catoxantha* Hamps.)," M.A.J., Vol. XIV, No. 10.

"Further remarks on *Ptychomyia remota* Ald.. A parasite of *Artona catoxantha* Hamps.," M.A.J., Vol. XIV, No. 10.

"A Preliminary note on Chalcid No. 1594. A parasite of *Ptychomyia remota* Ald.", M.A.J., Vol. XIV, No. 10.

A paper was read on "The Inter-relations of Insects with Cover and other crops to Rubber and Coconuts" at the Annual Conference of the Incorporated Society of Planters and on "The Insects of Coconuts in Malaya" at the Pan-Pacific Conference.

Investigations.

Although considerable time has been occupied in placing on record the results of previous work, progress has been made in the following special investigations.

"A survey of the economic insects of Malaya."

"*Leptocorisa* spp. and their relationship to padi."

"The economic importance and the control of *Tiratha* sp. near *trichogramma* Meyr."

Review of Insects of 1926.

(a) *Insects on Major Crops.*

(1) *Coconut.*

Artona catoxantha Hamps. No reported outbreaks of this Zygaenid moth were received during the year with the result that the investigation of this insect could not be continued. The conditions bringing about an outbreak are at present unknown, but there are indications suggesting that heat, smoke or fumes might be responsible for changing the conditions, thereby affecting the parasites and thus allowing the pest to increase rapidly. Three papers dealing with this moth and its parasites embodying the results of recent observations were published.

Setora nitens Walk. Considerable injury to young coconut palms by the caterpillars of this moth has again to be recorded. This insect is rarely troublesome to palms of 5 years of age and upwards. The reason for this is not quite clear; possibly the parasites which normally control it are absent in newly planted-up areas.

Mahasena sp. During the year most enquiries, relating to insects on coconuts, have been received concerning the control of the caterpillars of this Psychid moth. Most damage would seem to be done to young palms, but older palms are also attacked.

Hidari thrax Moore. This skipper is another sporadic pest which has occasionally been responsible for damaging older coconuts by stripping the leaves up to the veins. Damage is very localised, being confined to a few palms, and outbreaks are not of long duration.

Batrachedra arenosella Walk. Information concerning the status of this insect which causes injury to both male and female flowers in the unopened coconut spike has been sought. Published results (M.A.J., Vol. XII, No. 5) show that this insect was found to be responsible for causing only 1% of female flowers to fall.

Tirathaba sp. nr. *trichogramma* Meyr. The investigation on the economic importance and the control of this insect has been in progress since July. It has been found that if the sheath is entirely removed, the damage to both male and female flowers is negligible, and this measure is so entirely successful that further experiments for the control of this moth are not considered to be necessary. The extent of the nut-fall caused by this insect is now receiving considerable attention. An area of coconuts has been reserved on an Estate in the Sepang district and in the coming year, it is hoped that the importance of this insect to the coconut in-

dustry will be settled. The moth does not lay its eggs on widely-opened spikes, preferring to lay its eggs on the inflorescences of spikes, which burst inwards and are therefore more enclosed, being adpressed against the sheath and encircled by the bases of petioles. Inflorescences with over-hanging sheaths, allowing thereby the male flowers to fall, are generally free, but most inflorescences which have a few of their branches against the sheath or enclosed by the tip of a partially burst sheath, generally show signs of the presence of caterpillars. Spikes with transverse fibrous strands, preventing the inflorescences bursting, have been occasionally observed. Such inflorescences are always heavily infested and as many as 12 female flowers on one spike have been found to be destroyed. Spikes on young palms are frequently one mass of frass due to the spikes being more enclosed, smaller and slower in growth. Preliminary figures on this experimental area dealing with spikes allowed to open naturally seem to indicate that about 30% of the original flowers remain on the spike to become nuts, that about 10% are damaged by caterpillar and that about 60% fall from other causes. Female flowers and young nuts which are unattacked on the spike have frequently been found to be bored after falling; this has undoubtedly caused in some quarters an exaggerated idea of the damage considered to be caused by this insect.

Rhynchophorus schach Oliv. and *Oryctes rhinoceros* Linn. have not been much in evidence due largely to the enforcement of control measures. Palms up to about 5 years of age are generally most attacked by *Oryctes*, the reason being that some wild palms are not destroyed at the same time as other jungle stumps.

Plesispa reichei Chap. This two-coloured Hispid beetle seems to have been more in evidence in some parts of Malaya during the year. Although the grubs and adults of this beetle have never been known to cause the death of a palm, the precautionary measure of immersing the seedlings in lead arsenate before transplanting in the field should be done.

Diocalandra frumenti Guen. Enquiries as to the status of this small weevil have from time to time been received, but unlike *Diocalandra taitensis* Guerin, it does not bore into healthy tissue, attacking the fronds, trunks, spikes and young nuts. It is always associated with the decaying tissue of the palm and is frequently seen on and in fallen female flowers, sometimes also at the base of female flowers on the point of falling.

Valanga nigricornis Burm. This large grasshopper has occasioned some damage to coconut, African oil and areca palms where mimosa has been grown as a cover crop; it seems to be attracted first to the cover crop and then proceeds to cause injury to palms.

Oliarus sp. An outbreak of this bug on young coconut palms in the Klang district occurred. This is the first record in Malaya of this insect causing injury to coconuts.

(2) *African oil-palm.*

Unopened leaves of the African oil-palm have occasionally been seen to be damaged and on examination maggots of flies and other insect representatives have been found. At first, the palm appears to be suffering from disease, but the decay does not extend into the cabbage, indicating that insects are probably primarily responsible. The attacked leaves seem to regain their healthy appearance, with the exception that they have lost their tips and the ends are devoid of pinnae. The following identified insects have been bred from damaged leaves. The Lonchaeid flies, *Carpolonchaea calva* Bezzi and a *Carpolonchaea* sp., two Oscinid flies, *Gampsocera* spp. and the Lyonetiid moth, *Opogona leucodeta* Meyr. *Tambinia egpitata* Dist. with its nymphs have been recorded sucking the sap from the recently opened leaves and might be responsible for the scattered discolourations on the older leaves. The Aphids, *Cerataphis lataniae* Boisd., *Oregma nipae* v de Goot. and the Aleyrodid, *Aleurocanthus gateri* Corb., are common on the leaves and the two Coccids, *Paralecanium expansum* Green, var. new and *Ischnaspis longirostris* Sign. have been reported for the first time on this palm in Malaya.

(3) *Rubber.*

Several reports of damage to the tapping surface of rubber have been received during the year. Various caterpillars are found from time to time on the trunk of rubber trees, but all are not responsible for injuring the bark. Possibly the insect reported causing most frequent damage is the "case-worm", *Acanthopsyche snelleni* Heyl., but crickets and *Homodes brachteigutta* Hamps., have occasionally been responsible. At the beginning of the year, caterpillars, alleged to have injured the tapping cut throughout a fairly large area of rubber trees, were received from an Estate in Negri Sembilan. These caterpillars were bred out and the moths identified as *Palara implexata* Walk. The caterpillars of the Arctiid moth, *Chionaema amelaena* Hamps., have been recorded on one occasion causing slight damage to the bark of rubber trees. Caterpillars of the Lymantriid moth, (*Orgyia turbata* Butl), migrated from the cover crop, *Centrosema*, to young rubber, feeding slightly and pupating on the leaves, although in their immediate vicinity, *Centrosema* was growing luxuriantly. There are other records of insects in Malaya leaving a crop and turning their attention to rubber.

(4) *Padi.*

Nephotettix bipunctatus Fabr. This leaf-hopper caused some damage to padi in the Malacca area and was associated

with the Delphacid bug, *Sogata pallescens* Dist., in the Krian district.

Scotinophara coarctata F. This Pentatomid bug was reported as occasioning injury to padi in Pahang and advice concerning its control was sought from Siam.

Leptocorisa spp. The investigation of the economic importance and the control of *Leptocorisa* spp. has been in progress throughout the year and in connection with this work, periodical visits have been paid to Kuala Pilah and other districts. Although all species of *Leptocorisa* have been found on padi, *acuta* represents about 90% of the catches on this crop and is undoubtedly responsible for most of the loss. During the "dead" season, only occasional specimens of *acuta* have been collected, the majority being *varicornis*. When, however, the padi commences to flower, *acuta* is soon attracted, frequently in enormous numbers.

Agrotis sp. Hill padi planted in a new clearing near Kuala Kubu was badly attacked by the caterpillars of an unidentified Noctuid moth. On my visit the caterpillars were found to be so highly parasitised that control measures were rightly not considered to be necessary.

(b) *Insects on Minor crops.*

Croton.

Amyna punctum F. Outbreaks of this moth, resulting in the defoliation of croton, have been frequent. This is undoubtedly a pest of major importance and possibly the limiting factor to growing croton on a commercial scale.

Gambier.

Glyphodes coeruleiceps Hamps. The leaf-rolling caterpillar of this moth is generally present in small numbers on the leaves of gambier and has been reported from Johore and Pahang causing considerable damage.

Nipah.

Parasa lepida Cram. Nipah in one district suffered extensively from the attacks of larvae of this Limacodid moth. This is not the first record of an outbreak of this insect and, where this plant is grown on a commercial scale, material to combat this pest should always be in readiness.

Areca.

Wallacea palmarum Gestro. During the year instances of serious damage by the grubs and beetles of this Hispid to areca palms resulting in several cases in their death have

occurred. Unlike *Plesispa reichei* Chap., this beetle generally confines its attention to the bases of the young leaf petioles and injures the young unopened leaves. The brownish discolourations at the edges and the weather beaten appearance of the leaflets of the areca palm are often due to the damage caused by this insect to the young leaves.

In this report, I have only mentioned some of the more important records of insects which have come to my notice and according to previous custom, a paper will be published recording more detailed information concerning the Insects of 1926.

Annual Report of the Agriculturist (Rubber) for 1926.

Staff.

Mr. Spring, Agriculturist (Rubber) was in charge of this Division of the Department throughout the year.

During the year numerous visits to estates were made and advice given on general agricultural problems. Many enquiries were received regarding cover crops, manuring, budgrafting and seed selection, soil erosion, drainage and tapping.

Fern Growth in Rubber Areas.

Investigations were conducted to determine the effect of fern growth on the health and growth of the rubber tree. Nine estates were visited, and reports on each prepared as well as a scheme of experiment which is being carried out by several estate managers under the direction of the Agriculturist (Rubber). The trees on all the estates visited with the exception of those on one property, look healthy and are well grown. The foliage is generally excellent and the bark thick and succulent. No indication was found of any harmful results from the growing of ferns as a cover crop, but in the absence of experimental data, however, it is only possible to express an opinion that ferns are not harmful, in old rubber areas, provided the cover is free from lallang or other noxious weeds and is cut back occasionally. It is hoped that the experiments which are being undertaken will throw light on the subject and provide some definite information as to the value of ferns as a cover crop. The type of fern or moss best suited for the purpose requires investigation as well as the frequency of cutting back. Tall growing ferns must be cut back periodically, if left for a long period the remaining stubble is so strong that it is difficult for labourers to work, in any such area, without injury to the feet. Cutting is best done at the commencement of a wet season in order that the material may be left on the land without danger of fire. Tall growing ferns, if never cut back, are objectionable on account of the difficulties of supervision and the labourers work. Ferns provide an effective cover for the prevention of soil wash and are particularly valuable on areas where other vegetation is difficult to establish.

Staghorn moss (*Lycopodium*) is becoming popular as a cover crop in old rubber estates particularly on impoverished soils.

A preliminary report on "The Effect of Fern and Other Growth on the Health and Growth of the Rubber Tree" was published in the Malayan Agricultural Journal, Vol. XIV, No. 5, May, 1926, page 119.

Rubber Small Holdings.

A large number of small holdings were visited in order to ascertain whether the high price of rubber in the latter part of the year 1925 and the early part of 1926 had affected the quality and severity of tapping of Asiatic holdings. There was little evidence that it had done so but in some instances a more severe system of tapping was adopted and more bark removed over a given period when prices were high. The average standard of tapping to day is far superior to that of former years, the system of tapping being more conservative and a higher standard of tapping attained.

Longevity of Hevea Brasiliensis.

Experiments in respect of Longevity of Hevea brasiliensis were conducted on eleven estates throughout the year.

Records of weights of dry rubber are being taken from three experimental plots on each estate. The Agriculturist (Rubber) visited the properties and obtained check yields from the test plots.

A report on the Longevity of Hevea brasiliensis was published in the Malayan Agricultural Journal, Vol. XIV, No. 1, January, 1926, page 18. A further report on the subject will be published in the near future.

Dry Rubber Content.

Several estates were visited in order to determine the dry rubber content of the latex from trees in clean weeded fields and of trees in cover crop areas. The results obtained so far indicate that the dry rubber content of latex is not affected by a cover crop but it is proposed to make further investigations before arriving at any definite conclusion.

Bud-grafting.

Records of Yields of Rubber from Bud-grafted Trees on Kajang Estate, Selangor.

Results of yields of rubber from bud-grafted trees on Kajang Estate, Sungei Reko Division, were recorded by the Agriculturist (Rubber) and the results published in the Malayan Agricultural Journal, Vol. XIV, No. 2, February 1926, page 25. Further results were published in the same journal, Vol. XIV, No. 11, November 1926, page 351. Budding in the field commenced in October and November 1921.

Yields of dry rubber from test trees in Clone 9.

Average yield per tree from 23 trees on 14.8.26 = 29.1 grms.
Average yield per tree from 23 trees on 18.8.26 = 25.5 grms.
Average yield per tree from 23 trees on 9.9.26 = 32.5 grms.
Average yield per tree from 23 trees on 15.9.26 = 30.4 grms.
Average yield per tree from 23 trees on 17.9.26 = 28.4 grms.
Average yield per tree from 23 trees on 21.9.26 = 30.8 grms.

Yields of latex in c.cs. from test trees of Clone 1.

Average yield per tree from 15 trees on 14.8.26 = 109 c.cs.
Average yield per tree from 15 trees on 18.8.26 = 100 c.cs.
Average yield per tree from 15 trees on 9.9.26 = 101 c.cs.
Average yield per tree from 15 trees on 15.9.26 = 90 c.cs.
Average yield per tree from 15 trees on 17.9.26 = 82 c.cs.
Average yield per tree from 15 trees on 21.9.26 = 95 c.cs.

Clone 9. The highest average yield in clone 9, is from tree No. 603 giving 37.0 grms. of dry rubber, per tapping. The poorest yielder is tree No. 358 giving 21.8 grms. of dry rubber, per tapping. The dry weights of rubber obtained from all the trees of Clone 9 are remarkably high, an average of approximately 30 grms. of dry rubber, per tree, per tapping.

Clone 1. The highest average yield in those trees of Clone 1 which were included in these tests is from tree No. 337 giving 152 c.cs. per tapping. The poorest yielder is tree No. 392 giving 52 c.cs. per tapping.

Stock and Scion.—Observations were made in respect of union between stock and scion. The age of the stock has a considerable influence on the future growth of the tree but there are probably other factors responsible for abnormal development. In the case of budding on the 2½ year old stock all the test trees now show exceptionally bad union, the trunks bulge at the base enormously giving them a distinct club foot appearance while the trees which were budded on to when 9 months old do not show this abnormal development.

Bud-grafting should be undertaken as soon as the seedlings are sufficiently large to permit of the operation being carried out. The best age for stock seedlings is between 6 and 12 months old when there is a higher percentage of success, the work is easier and can be performed more speedily, less material is required and wounds are quickly concealed by rapid growth. When seedlings e.g. 2½ years old are cut back the exposed surface is so large and the healing process so slow that deterioration by infiltration of water may take place and cause rotting unless every precaution is taken.

Other factors for instance age of bud wood may have an influence on the growth at the point of union and although the age of the stock may not be entirely responsible for the swelling at the base of the trees yet, it is considered of sufficient importance to draw attention to the advisability of budding only on to young seedlings.

Investigations on the suitability of different kinds of bud wood are being made.

A resume of an article on Storing and Packing of Budding Wood was published in the Malayan Agricultural Journal Vol. XIV, No. 12, December, 1926, page 397. Mr. Spring held several demonstrations on bud grafting of rubber trees, staining of latex vessels and examination of the bast at headquarters. Arrangements have been made to give similar demonstrations on estates early next year.

Manuring of Rubber Estates.

Special attention was given to the question of manuring rubber estates in which much interest is now being taken. Nine estates were visited and recommendations made regarding manurial experiments. In several estates, the tests, as planned by this Department, have been commenced. Mr. Spring selected the test plots and advised generally on conducting the experiments.

Apart from the very successful results obtained on a certain type of soil on the estates of the Holland American Plantation Maatschaapij in Sumatra, little information is available on results obtained by the application of artificial fertilizers to rubber cultivation. With our present state of knowledge it is advisable first to conduct experimental field tests on small areas, before recommending the wholesale application of any artificial fertilizer.

Quotations for the supply of artificial fertilizers have been obtained from several local firms and may be had on application to this Department.

An article on the Manuring of Rubber Estates appeared in the Malayan Agricultural Journal, Vol. XIV, No. 11, November, 1926, page 365.

Replanting of Rubber Areas.

A memorandum on the replanting of exhausted areas of rubber containing recommendations for experimental work was prepared by the Agricultural Chemist and Agriculturist (Rubber).

Several replanted areas of rubber were inspected and the Agriculturist (Rubber) was much impressed with the good

results obtained. In a replanting programme the most up to date methods of planting should be included. After the old rubber trees have been removed, through tillage is essential. Liming and the application of artificial manures should be considered in conjunction with the particular soil type. On undulating and hill land all precautions must be taken to prevent soil erosion, by means of terracing, contour catch pits or bunding; a combination of two may be necessary on steep land. When the soil has been brought to a good tilth it is wise to establish a cover crop and the most suitable one at this stage of the development of the property would appear to be *Calopogonium mucunoides*.

Cover Crops.

The growing of cover crops in both young and old clearings has received much attention during the year.

For young areas *Calopogonium mucunoides* is the most suitable. The Sarawak Bean (*Dolichos Hosei*) is an ideal cover plant for mature rubber areas but it is hard to establish in improverished soils. On poor soils the positions where the seeds or cuttings are to be planted require to be cultivated and good soil containing plenty of humus applied and cattle manure if available.

Naturally one would prefer a leguminous cover crop but in the case of impoverished soils and lands which have suffered to any extent from soil wash they are extremely hard to establish. A non-leguminous plant giving a first class cover is much preferable to a leguminous one which, on a particular soil may not provide a satisfactory cover.

Mikania scandens has received some attention as a cover plant. It belongs to the Order Compositae and is commonly found growing in this country. It is very rapid in growth and thrives under shade. From observations made it would appear to have considerable possibilities. Selective weeding has become a fairly common practice in old estates.

An article on cover crops was prepared for the Chinese Departmental publication.

Malayan Exhibition, Kuala Lumpur, 1926.

Mr. Spring acted as Honorary Secretary for the Rubber, Gums and Resins Section.

The Rubber section was well represented and the exhibits were of a high standard.

Annual Report of Plant Physiologist for 1926.

Staff.

Mr. W. N. C. Belgrave, Plant Physiologist was on long leave until September 15th and Mr. R. O. Bishop, Assistant Agricultural Chemist acted during this period and continued to work in this Division until November 1st.

Investigations.

Investigations until September were entirely on rubber, and continued and extended previous lines of work in this Laboratory. Four hitherto unrecorded bodies were isolated.* three of which were proteins differing in coagulation properties, while the fourth was a waxy phospho-compound. A number of methods of preparing this fourth body were investigated.

Observations on the effects of ammonia on latex during storage were continued and an article on the subject will appear shortly in the Malayan Agricultural Journal.†

Observations on experiments on early and drastic thinning of rubber were continued.

In view of the formation of the Rubber Research Institute, it was decided in September that no new rubber work should be undertaken, and attention was given to preliminary work on soil problems, with a view to testing the applicability or otherwise of standard methods of analysis to local soils and conditions.

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* An account of the work has since been published v. M.A.J., XV No. 2 p. 27, 1927.

† M. A. J. XV No. 1 p. 1, 1927.

Annual Report of the Agriculturist, for 1926.

Staff.

Mr. E. A. Curtler, Assistant Agriculturist, proceeded on leave on the 19th June.

Mr. T. D. Marsh, Assistant Agriculturist, returned from leave and assumed duty on the 16th July.

Mr. H. C. Chevally, Temporary Superintendant, Government Plantations, Kuala Lumpur, left the service on the 15th January.

Mr. A. L. Sinclair, who was appointed Temporary Superintendent in place of Mr. Chevally, assumed duty on the 13th March.

Expenditure and Revenue.

The total expenditure on the Experimental Plantations for the year under review was $147,583.70, whilst the revenue from various sources was $11,531.25.

Experimental Plantation, Serdang.

The development of this plantation was continued and during the year an area of 67 acres of felled jungle in the East Division was burnt and cleared of all timber. This land is to be utilised partly for a Stock Farm and partly for the planting of local fruit trees.

A further area of 7 acres in Block No 32 was cleared and laid out as a permanent fruit nursery. A laterite road with the necessary connecting paths was laid through this area for the transport of planting material.

At the close of the year an area of 753 acres had been opened up and about 630 acres of this area had been planted with various crops, whilst the area held in reserve was approximately 773 acres.

A new laterite road was made through the centre of the East Division, and a similar road was constructed through the area reserved for the Stock Farm.

The following is a list of additional crops planted during the year:—

(a) *West Division—Hydnocarpus Wightiana*, 25 acres, Oil Palm 10 acres, Papaya 2 acres, Rubber (Hevea) 10 acres and Tengkawang 4 acres.

(b) *East Division*—Bananas 1½ acres, Coffee 7 acres, Cotton 1½ acres, *Hydnocarpus Wightiana*, 2 acres, Kapok 10 acres, Ramie fibre 1 acre, Tapioca 12 acres and Tuba puteh 5 acres.

The fruit nursery was well-stocked with various seedlings for planting up the newly-opened fruit area in the East Division.

A large quantity of planting material was forwarded to headquarters throughout the year for distribution purposes. This included seeds and cuttings of different varieties of economic crops under cultivation in addition to the various fodder grasses and cover crops which have so far been established on the plantation.

The following new planting material was introduced during the year:—

With a view to carrying out seed selection work on oil palm the introduction of seed of different varieties of this palm from West Africa was undertaken and the undermentioned material has so far been received at Serdang—1 variety from the Department of Agriculture, Njala, Sierra Leone, 20 varieties from the Jardin Botanique d' Eala, Congo Belge, 3 varieties from the Department of Agriculture, Ibadan, Nigeria and 4 varieties from the Governor General de l' Afrique Occidentale Française, Bingerville, Republic Francaise.

In addition to the above seeds of *Adenanthera microsperma*, *Albizzia glabresens*, *A. procera*, *Araucaria brasiliana*, *Cassia bacillaris*, *C. laevigata*, *Casuarina distyla*, *C. torulosa*, *Coffea bukobensis*, *Flacourtia Ramontchi*, *Grevillea Banksii*, *G. Hilliana*, *Ilex paraguensis*, *Peltrophorum dasyrachis*, *Psidium pumilum*, *P. sinensis* and *Terminalia Chebula* were received from the Department of Agriculture, Dar-es-Salam, Tanganyika Territory.

Seeds of *Taraktogenos Kurzii* were also received from the Conservator of Forests, Utilization Circle, Burma.

The position as regards labour on this plantation has now considerably improved and no less than 170 Tamil coolies were recruited from India during the period under review. It was thus possible during the latter part of the year to dispense with the Chinese casual labour, which was formerly engaged from day to day as required. The number of Tamil coolies resident on the plantation at the end of the year was 328 coolies, which is considered almost sufficient for present requirements.

A school for the education of Tamil children resident on the plantation was opened in February and at the close of the year there were 37 pupils on the school register.

The general health of the resident labour force during the year was good. A Visiting Dresser from the Sungei Besi Government Dispensary attends the plantation regularly to examine any sick coolies, whilst the oiling of ravines on the

plantation is systematically carried out as an anti-malarial measure.

The following new buildings were erected on the plantation during the year:—

2 sets of Cooly Lines (20 rooms each)

1 ,, ,, Cooly Line Kitchen (10 rooms)

1 ,, ,, Cooly Line Latrine

2 ,, ,, Cooly Line Bathrooms.

All existing buildings have been maintained in good order.

As in the past insect pests and fungoid diseases have given a certain amount of trouble during the year. A Pest Gang has been continuously employed on the plantation and has managed to deal with the more serious outbreaks of injurious insect pests. Both the Entomologist and Mycologist of the Department have given ready assistance when required.

A small plot of Sisal Hemp was harvested during the year and about 4 tons of cleaned fibre were prepared by the experimental decorticating machinery recently installed on this plantation. A representative sample of about 3 tons of this fibre was forwarded for sale in London at the end of the year.

A trial was made on a small scale in connection with the extraction of both Manila Hemp and Caraguata fibre with this machinery, but difficulty was experienced in obtaining a fibre sufficiently light in colour.

A small treadle operated oil palm nut-cracking machine was received at the close of the year. It was not at all satisfactory when operated by the treadle, but proved very efficient when driven by power.

A preliminary experiment was conducted, in conjunction with the Chemical Division, in the production of Synthetic Farmyard Manure from "Lalang" by the Adco process. In this experiment 5 tons of fresh lalang produced approximately 8 tons of synthetic manure, which compared favourably in composition with the natural product. The effect of this manure on the growth of Tapioca is now being tested.

Investigations with Oil Palms were continued with special reference to (a) crop records, (b) artificial pollination, (c) effect of light and heavy pruning, (d) growth records and (e) the effect of intercrops, catchcrops, cover crops and green manures.

A large number of investigations with Tapioca, Sweet Potatoes, Yams, Maize, Tuba and other crops are also being carried out the results of which are published from time to time in the Malayan Agricultural Journal.

A start was made in connection with the formation of a Stock Farm and a Montgomery bull, four cows and three calves were received on the plantation at the end of the year. A temporary shed was erected for their accommodation until more permanent quarters can be provided.

A fully equipped Meteorological Station was installed on the plantation during the second half of the year. Records were taken of the wind velocity by means of a cup-indicating anemometer.

Rain fell on 182 days during the year, giving a total rainfall of 87.03 inches against 101.94 inches in 1925.

A large number of visitors were shown round the plantation during the year. His Excellency the High Commissioner (Sir Laurence Nunns Guillemard, G.C.M.G., K.C.B.) visited the plantation on the 15th March.

Experimental Plantation, Kuala Lumpur.

This plantation was maintained in good order throughout the year, whilst several minor improvements, such as terracing and turfing of slopes were carried out as labour became available for such work.

The principal object of this plantation is to supply various forms of planting material for distribution purposes and during the period under review the requirements of no less than 529 applicants were met in this direction.

Whilst the major portion of the material was distributed locally a fairly large quantity was forwarded to other Agricultural Departments, principally in exchange for similar material of plants hitherto not represented in this country.

Castleton Estate, Teluk Anson.

Mr. A. Robertson remained in temporary charge of this plantation until the 28th February.

In view of the formation of the Rubber Research Institute last year all experimental work with rubber was discontinued on this plantation and it was decided to dispose of the area of approximately 199 acres under rubber.

The above area, together with one set of cooly lines, was sold by Public Auction at Teluk Anson in February and realised the sum of $210,000/-

Experiment Station, Cameron's Highlands.

Mr J. P. K. Wilkins, Superintendent, remained in charge throughout the year.

This plantation is being opened up at an elevation of about 4,800 feet with the object of carrying out experimental work in connection with hill crops such as Cinchona, Tea and Coffee.

A block of land consisting of about 200 acres has been specially reserved for this particular purpose at Tanah Rata, which is situated at the present entrance to the Highlands.

Work on the felling and clearing of this land was commenced in January and at the end of the year an area of 75 acres had been felled and burnt by Sakai labour on daily pay at a cost of about $20/- per acre. About 40 acres of this area has been partially cleared of timber by permanent Tamil labour in preparation for planting. Work on terracing and contouring of this area is now in progress.

A site was selected for a permanent nursery and an area of about 1 acre of this block was stumped and cleared of all timber for the propagation of new planting material.

The following crops have been established on a small experimental scale:—Cinchona (*Succirubra* and *Ledgeriana*), Tea (Dangri, Dhonjan and Rajghur), Coffee (Liberian hybrid), Cocoa, Lemon, Pomelo, Tree-Tomato, Guava. Strawberry and Grasses (Australian Blue Couch, Carpet and Guinea grass) in addition to several ornamental trees (*Acacia*, *Albizzia* and *Casuarina*.)

Further supplies of Cinchona seed from Java and Tea seed from Assam were received at the end of the year.

There was some considerable difficulty at the beginning of the year in obtaining permanent labour and for a time it was found necessary to rely almost entirely on casual Sakai labour. It was eventually decided to introduce Tamil labour and during the latter half of the year a permanent labour force consisting of 35 Tamil coolies had been established on the plantation. In addition there was a number of casual Punjabie labourers being given temporary employment.

The following buildings were erected on the plantation during the year under the supervision of the Executive Engineer, Batang Padang:—

(1) Office and Store

(2) One set of temporary Cooly lines (8 rooms)

(3) Bungalow for Superintendent (3 rooms).

Transport of both food supplies and materials to the plantation is naturally a difficult problem at present, but this will gradually become less pronounced as the development of road communications to the Highlands is extended.

The following Meteorological figures which were taken at Tanah Rata under the supervision of the Meteorological Officer may be of interest:—

Rain fell on 207 days during the year, giving a total rainfall of 109.46 inches as against 144.91 inches in 1925.

The mean maximum temperature during the same period was 72.5°F (highest maximum 78°F) and the mean minimum 56.0°F (lowest minimum 43°F).

The total sunshine recorded was 1551.25 hours for the year, which gives an average of 4.25 hours of sunshine per diem.

The Hon'ble the Chief Seretary to Government, (Sir George W. Maxwell, K.B.E., C.M.G.) accompanied by members of the Cameron's Highlands Development Committee, visited Tanah Rata in January and inspected the work in progress on the plantation.

Mr. J. N. Milsum, Senior Assistant Agriculturist, also visited Cameron's Highlands in January in connection with the development of this new Experimental Plantation.

General Agriculture.

A large number of enquiries were received by the Department during the year regarding the cultivation of various agricultural crops. Although a large number were connected with the two main crops Rubber and Coconuts, considerable interest was shown in subsidiary crops such as Oil palm, Tapioca, Gambier, Coffee, Tuba (*Derris*), Annatto, Sisal, Chaulmoogra Oil, Pineapples, Bananas, Fodder grasses, Cover crops and native fruits.

Coconuts.

The price of copra has weakened slightly during the period under review. In the Singapore Market the highest price for sun-dried copra was $12.45 per picul in March and the lowest $10.20 per picul in December, giving an average price for the year of $11.53 per picul against $12.17 per picul in 1925. The export of copra from the Federated Malay States for 1926 was 65,829 tons valued at $12,851,770/- as against 57,997 tons in 1925.

Oil Palms.

The interest taken in the cultivation of oil palm has been maintained and it is estimated that there are now about

10,000 acres planted with this crop in the Federated Malay States.

The Department has undertaken the introduction of new varieties of oil palm from West Africa with a view to selecting improved strains of seed for ultimate distribution throughout the country. A large number of different types of seed have already been received from various palm-oil producing countries in West Africa and these have been planted up at Serdang for future observation.

Experiments recently carried out at Serdang in connection with the germination of oil palm seeds has shown that germination can be considerably accelerated by placing the seed in washed sand beds which are covered with glass frames to increase the temperature of the germination beds. The result of these experiments will shortly be published in the Malayan Agricultural Journal and should prove of real practical value in the development of this comparatively new industry.

Approximately 726 tons of palm oil valued at $254,165/- and 180 tons of palm kernels valued at $36,708/- were exported from the Federated Malay States during the period under review.

Tapioca.

The experiments started at Serdang with the object of establishing a suitable rotation for this crop have been continued and the first crop was harvested during the year.

A number of new varieties of Tapioca were introduced from Java and the Philippine Islands. A paper showing the comparative yields of these and native varieties is being prepared for publication in the Malayan Agricultural Journal.

Gambier.

There has been a considerable depreciation in the price of gambier during the year and the present price of $9.50 per picul for bale gambier leaves little margin for profit. The market price of this product, however, is liable to considerable fluctuation, according to supply and demand, and better prices may be expected should the figures of production show any considerable falling off in the near future.

Coffee.

There has been a fair demand for both Liberian and Robusta coffee and good prices have been realised for these products during the period under review with the result that numerous enquiries have been received regarding the planting of these crops on a small scale to meet local requirements.

Tuba Root.

Experiments are being conducted at Serdang to test the comparative values of the different varieties of Tuba (*Derris*) both from the point of view of yields and insecticidal purposes.

A consignment of 10 cwts of Tuba puteh was forwarded to Prof. McCombie of Cambridge University, who is conducting special research work on the toxin in tuba root. The result of his investigations will be forwarded to the Department in due course.

Annatto.

A further consignment of Annatto seed produced at the Experimental Plantation, Serdang was ready for shipment at the end of the year, but it was impossible to find a market for the produce. Latest advices from London state that really good quality Jamaica and/or Madras Annatto seed were obtainable on the spot at 3d. per lb. ex warehouse London, whilst offers for the new crop (1927 crop) are on the market at 29/- per cwt. nett c.i.f. London, shipment from origins (Jamaica or Madras) but no business passing.

There is apparently a very limited market for this particular produce and the present prices would barely cover the cost of collection and preparation for market.

Sisal Hemp.

The harvesting of a block of Sisal Hemp was commenced at the Experimental Plantation, Serdang at the beginning of the year and the experimental fibre decorticating machinery previously installed on this plantation produced a fairly good sample of marketable fibre. Arrangements were made for the shipment of a fair-sized consignment of this fibre for sale in London through the Malay States Information Agency at the beginning of October.

A report on this sample by Messrs. Wigglesworth & Co. of London stated that the fibre compared favourably with the material from Accra, West Coast of Africa, but is a lower quality than that from the East African Coast. Further, they judged from the sample submitted that the soil and conditions in Malaya were suitable for cultivation of Sisal in this country and with prices ruling satisfactorily they recommended the cultivation of Sisal on a commercial scale.

A sample bale was also forwarded to Hongkong and a report on the quality of this fibre stated that the bale was opened and found to contain a fairly clean light-coloured fibre, average 3 feet in length, and slightly coarser than Cebu Maguey No. 2, but a little better cleaned. The tests carried out compared favourably with Cebu Maguey No. 2.

The firm to whom it was sent, stated that they were prepared to place an order for 100/200 bales of this fibre monthly at a cost not exceeding 10 cents (Straits currency) per lb. c.i.f. Hongkong packed in bales of not more than 280 lbs. gross.

Chaulmoogra Oil.

Extensive experiments are being carried out with this crop at Serdang and fair-sized experimental areas have been planted up with *Hydnocarpus Wightiana* and *H. anthelmintica* in addition to a small plot of *Taraktogenos Kurzii* with a view to the production of chaulmoogra oil for the cure of leprosy.

An article on the behaviour of these recently introduced trees at the Experimental Plantation, Serdang has been specially prepared for publication in the Bulletin of Miscellaneous Information, Royal Botanic Gardens, Kew and a reprint of this article will subsequently appear in the Malayan Agricultural Journal.

Pineapples.

The collection of different varieties of pineapples has been continued and a fair number of different types have now been established at Serdang. It will of course take some considerable time before the various types can be properly classified, but once this is completed it will be possible to distribute a number of improved varieties throughout the country.

The export of canned pineapples from the Federated Malay States during the year was 3,940 tons valued at $701,115/- as against 4,988 tons valued $837,477/- in 1925.

Bananas.

Twenty standard named varieties of bananas planted during the later part of 1925 as a catch-crop in two one-acre plots amongst oil palms were subject to observation. These plots form part of an experiment to ascertain the effect of various catch-crops on the growh of oil palms.

A similar number of varieties were picked out as being of major importance and a commencement was made to plant up 7 suckers of each variety in the newly-established fruit nursery. Detailed data are being recorded regarding these varieties with special reference to the period of maturity, yield and quality of the fruits.

The Mycologist is now making a special investigation of Banana diseases in order to ascertain whether any varieties are resistant to "Panama" disease.

Fodder Grasses.

Experiments were made at Serdang with various types of fodder grasses and Guinea grass, *Panicum maximum*, was

found to be by far the most suitable grass for this particular purpose.

A recent introduction was Buffal grass, *Reana luxurians*, which is rather a coarse type of grass giving a heavy yield, but has not yet been tested for feeding purposes.

A preliminary test was conducted with Molasses grass, *Melinus minutiflora*, the results of which have been published in the Malayan Agricultural Journal.

Cover Crops.

The experimental work being carried out at Serdang in connection with the different types of cover plants has been continued.

So far *Calopogonium mucunoides*, *Centrosema pubescens*, *Dolichos Hosei* and *Peuraria javanica* appear to be the most suitable low-growing covers for the prevention of soil wash on hilly or undulating land.

Publications.

The following articles were published by members of the Staff of the Agricultural Division during the year 1926:—

Experiments on the Germination of African Oil Palm Seeds. E. A. Curtler, Malayan Agricultural Journal, Vol. XIV, No. 4.

Annual Report of the Agriculturist for the year 1925. B. Bunting, Malayan Agricultural Journal, Vol. XIV, No. 6.

Notes on Condiments used in Curries. J. N. Milsum, Malayan Agricultural Journal, Vol. XIV, No. 8.

Preliminary Report on Molasses Grass. J. N. Milsum, Malayan Agricultural Journal, Vol. XIV, No. 9.

Pollination Experiments with Oil Palms. J. N. Milsum and E. A. Curtler, Malayan Agricultural Journal, Vol. XIV, No. 12.

Further Crop Records of Yams. J. N. Milsum, Malayan Agricultural Journal, Vol. XIV, No. 12.

General.

A number of visits were made to estates in connection with various agricultural problems and advice was frequently given on the cultivation of crops other than rubber.

Report of the Agricultural Economist for 1926.

Staff.

The staff consisted of the Agricultural Economist, two Junior Agricultural Assistants, and one Malay writer.

Review of Crops.

Rubber.

(a) *Areas.*—An estimate by the Controller of Rubber Exports, of the effective acreage of rubber in bearing, or capable of being brought into bearing in Malaya at short notice is 2,110,000 acres, made up as follows:—Federated Malay States 1,140,000 acres ; Straits Settlements 295,000 acres; Johore 450,000 acres; Kedah and Perlis 185,000 acres; Kelantan 33,000 acres; Trengganu 7,000 acres. The actual planted area is of course in excess of these figures, as allowance must be made for areas that have not yet reached the stage of bearing.

The Department of Agriculture has directed enquiry annually through the various Land Offices, as to the area planted with rubber during each year.

The returns are somewhat unreliable; but as far as they go they shew that the total area planted during the year 1926 is probably about 50,000 acres against about 25,000 acres for the year 1925.

The big increase in planted area during 1926 over that of the previous year points to the degree of confidence in the future of the industry exhibited by the investing public.

(b) *Crop.*—The import of para rubber during the year* was 151,246 tons, while the exports over the same period amounted to 391,336 tons of rubber, and 2,078,701 gallons of latex produced in Malaya.

The exportable allowance under the rubber restriction scheme was January 85%, February to October 100%, November to December 80% of Standard Production.

(c) *The Rubber Market.*—The price of rubber in Singapore opened at $1.54 per lb. but declined steadily during the first two months until it stood at 85 cents per lb. at the end of February. After a temporary rise in March to $1.08 thereafter it declined steadily to 78 cents per lb. at the beginning of May. It subsequently continued steady until the middle of November when there was a further slight decline of about 5 cents per lb. the price closing at 65 cents per lb. at the end of the year.

* As stated in the "Annual Summary of Monthly Return of Foreign Imports and Exports of British Malaya for the year ending 31st December 1926."

Rubber stocks in London were stated to be 6,250 tons on January 1st, but they increased steadily during the year until on December 31st, stocks in London and Liverpool had risen to 51,243 tons. The World's visible stocks at the end of the year were said to be about 65,000 tons higher than at the end of 1925.

Fears were felt in some quarters that increased Dutch supplies might be expected from native holdings in such quantity as seriously to upset the market. Figures now available however shew that the production from this source is unchanged, although Netherland East Indies estates production increased by 17,000 tons. The large increase in consumption of reclaimed rubber in America from 137,000 tons in 1925 to between 165,000 and 185,000 tons in 1926, being a ratio to crude of about 47%, as compared with about 35% in 1925 materially influenced the consumption of plantation rubber during the year.

Coconuts.

At the beginning of January the price of copra was $12/- per picul (133⅓ lb.) on the Singapore market, but it then fell rapidly to $11.10 at the end of the month. By the end of February it had risen again steadily to $12.30 and it subsequently varied slightly between $11.60 and $12.30 until the end of July. During the remainder of the year the price showed a slow downward tendency with occasional recoveries, resulting in a closing price $10.10 at the end of December. The average price for the year was about $11.80 as compared with $11.95 in 1924 and $12.15 in 1925. The industry has continued in the same satisfactory condition in which it has been during the last few years.

In the following table are given figures kindly supplied by the Commissioner of Trade and Customs shewing the export of copra from the Federated Malay States for the last three years.

TABLE 1.

Export of Copra from Federated Malay States.

State.	Quantity in tons.			Value in dollars.		
	1924	1925	1926	1924	1925	1926
Perak -	38,545	40,007	44,542	6,914,055	7,830,274	8,905,033
Selangor -	12,900	15,426	16,963	2,427,188	2,909,119	3,212,553
N. Sembilan	1,179	2,236	3,417	203,930	463,494	575,151
Pahang -	560	315	907	95,839	57,412	158,733
Total F.M.S.	53,184	57,984	65,829	9,641,012	11,260,299	12,851,770

The net export of copra from British Malaya during the last two years was as follows:—

TABLE 2.

Net exports of Copra from British Malaya.

Year.	Quantity in tons.	Value in dollars.
1925	96,554	19,093,938
1926	104,653	21,852,330

The slow but steady extension of coconut cultivation is a satisfactory feature of agriculture in Malaya during recent years. In view of the remarks which follow in another part of this report, on the influence of agriculture in the development of Malaya, it seems unfortunate that the lack of suitable land must before long put an end to expansion of the area under this crop in Perak, Selangor and Negri Sembilan.

Rice.

Local rice crop statistics will be found in the Annual Report of the Economic Botanist.

In order to sustain our population, it was necessary to import over seventy million dollars worth of rice. Nor was Malaya the only Eastern nation that was unable to feed her population without depending upon the three main sources of supply viz. India, Siam and French Cochin China. In 1920 China, Japan, Korea, the Philippine Islands, the Netherland East Indies and Ceylon obtained 1,097,000 tons for this purpose. In 1925 the aggregate imports of rice to these countries had risen to 2,306,000 tons. The importers include China, whose imports of rice during that period rose from 70,000 tons to 752,000 tons. Not only are the rice imports of these nations increasing from year to year, but there is a growing tendency for them to turn to India for their supplies. This, as is shewn by the following table, is because India alone has been able to produce and export rice to meet this increased demand. As an instance of this growing reliance on India may be cited the example of Japan which imported from Burma one ton of rice in 1920, a figure which rapidly increased to 199,832 tons in 1926.

TABLE 3.

Production and Export of Rice.

Country.	Production (in thousands of tons.)		Exports (in thousands of tons.)	
	1920	1925	1920	1925
India - -	27,662	30,857*	1,058	2,469
Siam - -	4,244	4,162	441	1,115
French Cochin China -	4,544	5,671	1,189	1,426

It is a pertinant question to ask for what length of time India, and to a lesser extent Siam, will be capable of this elasticity?

The encroachment of other countries on our main source of supply of rice is increasingly felt in Malaya by the constant rise in the price of rice.

Oil Palms.

Oil Palms continue to engage the attention of planters, but the extension of the area planted during the year does not, perhaps, give a true representation of the value of this crop.

* Yield in 1925, about one million tons below average of last seven years.

TABLE 4

Annual Planting of Oil Palms in Malaya. Acres.

State.	Year											
	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	Total
Selangor - -	10	100	253	270	440	952	393	1,391	1,924	1,930	1,694	9,357
Perak - -	...	...	...	...	...	...	...	...	220	...	622	842
Negri Sembilan - -	...	...	...	...	...	...	...	...	...	...	100	100
Johore - -	...	...	...	...		...	30	...	10	962	1,000	2,002
Penang - -	...	...	...	...	...	...	...	...	...	...	15	15
Kelantan - -	...	...	...	...	...	...	...	...	...	...	200	200
Kedah - -	...	...	...	...	...	...	...	...	...	...	32	32
Total planted annually - -	10	100	253	270	440	952	423	1,391	2,154	3,139	3,416	12,548
Total planted to date - -	10	100	363	633	1,073	2,025	2,448	3,839	5,993	9,132	12,548	

Apart from small experimental areas, there are nineteen oil palm estates in Malaya. Of these, one estate has over 2,000 acres planted, three have between 1,000 and 2,000 acres planted, and five have between 400 and 800 acres planted.

The following table giving the total area alienated, planted, and reserved for alienation for the cultivation of oil palms indicates the general trend of planting and of the attitude of Government towards encouraging this new and important industry.

TABLE 5.

Statistics of Areas for Oil Palms in Mayala.

State.	Total Planted. Acres.	Total Alienated but not yet planted. Acres.	Total provisionally reserved for alienation for oil palms cultivation, but not yet alienated. Acres.
Perak -	812	3,098	9,000
Selangor -	9,357	12,573	1,300
Negri Sembilan -	100	7,000	10,000
Pahang -	...	4,803	98,260
Johore -	1,992	5,300	...
Penang -	15	...	..
Kelantan -	200	...	...
Kedah -	32	...	...
Totals -	12,548	32,774	118,560

It is not yet proved that all of the areas reserved for alienation for this form of cultivation are suitable for the purpose.

There are now two up-to-date oil extraction and nut cracking plants and another is to be erected in 1927. The total crops were as follows:—

TABLE 6.

Yield in tons of Palm oil and kernel in Malaya.

Description of Product.	Year.			
	1923	1924	1925	1926
Palm oil -	195	286	536	751
Kernel -	50	81	110	168

The improvements that are being made in machinery for extraction of the oil and cracking the kernels should stimulate this promising industry. Prices obtained for plantation palm oil continue to be in advance of those of the West African product.

Many improvements have been made during the last two or three years towards the more scientific manipulation of this crop both in the field and in the factory, resulting in maintaining the purity of the product and lowering the cost of production.

Miscellaneous Crops.

TABLE 7.

Area under Miscellaneous Crops in the Federated Malay States.

Crop.	STATE.				Total
	Perak	Selangor	N. Sembilan	Pahang	
Oil Palms -	842	9,153	100	...	10,093
Pineapples -	407	3,954	313	50	4,724
Nipah -	4,225	1,643	413	800	7,081
Coffee -	166	4,163	549	55	4,933
Tapioca -	26	959	238	250	1,473
Gambier -	...	80	1,150	5	1,235
Tuba -	895	3	250	...	628
Arecanuts -	170	106	...	700	976
Sago -	106	...	...	...	106
Kapok -	88	70	...	50	208

The Nipah area include those that either are definite plantations, or areas worked for the production of "atap" etc. All the figures in the above table relate to definite areas, and do not include the numerous native homesteads of mixed fruits and other forms of cultivation.

The following table relating to the Straits Settlements and Unfederated Malay States must be taken as approximate only, as collection of statistics in some cases is extremely difficult.

TABLE 8.

Area under Miscellaneous Crops in S.S. & F.M.S.

Crop	Straits Settlements			Unfederated Malay States				Total
	S'pore	Malacca	Penang	Kedah	Johore	Kelantan	Trengganu	
Tapioca -	..	400	1,300	10,500	16,500	..	3,000	31,700
Sago -	...	..	..	..	800	..	....	800
Gambier -	...	70	..	...	1,500	..	5,000	6,570
Arecanuts -	...	...	..		8,000	...	200	8,200
Pineapples -	2,000	210	600	165	15,000	...	1,000	18,975
Tuba -	...	...	...		800	..	10	810
Coffee -	.	150	.	350	500	..	50	1,050
Tobacco -	.	...	..	80	...	...	100	180
Bananas -	...	...	...	2,430	...	..	300	2,730
Spices -	...	..	..	30	...	...	100	130
Oil Palms -		...		..	...	..	...	...
Nipah -		600	2,500	...	..	..	500	3,600

The market prices of almost all crops declined during the year. The most severe drop was that of gambier, which in January stood at $24 per pikul, advanced in March to $26, but fell away until in December it was quoted at $17 per picul. The rapid fluctuations in price of minor crops militates considerably against their regular production, but there seems no immediate possibility of regulating the prices of such crops as are treated as catch crops.

THE AGRICULTURAL POSITION OF MALAYA.

The economic position of Malaya is largely influenced by the supply of the foodstuffs required for her alien population, upon whom the progress of the country is largely dependant.

Locally grown agricultural products exported in 1926 were valued at over six hundred million dollars, of which rubber accounted for over five-sixth. Other products of minor importance included copra, pineapples, arecanuts, tapioca, sago and gambier. Apart from rice, it was necessary to import over $30,000,000 worth of foodstuffs which are capable of production in this country. These may be grouped as follows:—

Oils	...	$ 5,500,000
Meat (dead and alive)	...	12,000,000
Poultry and Eggs	...	1,500,000
Tea	...	4,000,000
Coffee	...	2,500,000
Dairy produce	...	1,000,000
Feeding stuffs for animals	...	6,500,000

Whether it is economically possible to produce such foodstuffs locally may be open to question, but until the country relies less on imports for all its foodstuffs, there will be no appreciable relief from the present high cost of living. The Economic Division has been engaged in the consideration of the agricultural industries of the country and the possibilities of expansion in each case.

As will be seen from forgoing tables the area under coffee is negligible. There is scope here for another 25,000 acres under this crop, which in full bearing would only just be able to make Malaya self supporting in this respect.

The import of oils into Malaya amounts to a very large figure. It consists almost entirely of kachang oil and ground nuts. It is possible that land may exist suitable for the production of this crop, or it might be possible to substitute palm oil at competitive prices.

Economic Investigations.

Areca nuts.—An investigation was made of the areas planted with this crop, and of the market conditions in this and other countries. It was found that there was a very large export of areca nuts, mostly for India, from the Netherland East Indies, Malaya and Ceylon, with Singapore as the main market. The price realised for the local product was inferior to that of many grades from Ceylon. The Economic Botanist reached certain conclusions regarding grades of nut on the market, while the writer came to the conclusion that there was scope for a larger area under this crop, which if treated on sound plantation conditions, would prove a profitable investment, and result in the production of nuts of first quality which would compete successfully with those produced elsewhere.

Canned Fruit.—Considerable attention was given to this valuable minor agricultural industry. The exports during the past few years are shewn in the following table compiled from official returns.

Table 9.

Export of Canned Pineapples from British Malaya.

Year.	Quantity.	Total value.
1919	255,873 cases	$3,286,001
1920	446,893 ,,	7,178,016
1921	662,630 ,,	6,210,383
1922	710,671 ,,	6,694,098
1923	889,941 ,,	5,874,858
1924	39,204 tons	8,873,977
1925	43,207 ,,	8,236,824
1926	40,634 ,,	7,669,784

The decrease in exports is due to the falling off of crops, and to a reorganisation amongst canners. It is reported that there are several good areas coming into bearing in Johore, so that supplies should be maintained in the next few years.

The Imperial Economic Committee, in a special report, directed attention to the Empire production and marketing of fruit. The report was reviewed and abstracts sent to all important pineapple canners and exporters in Malaya. The opinions of commercial interests was studied with a view to deciding in what ways the industry might be improved. In view of the importance of the pineapple industry in Johore, the co-operation of the Inspector of Agriculture, Johore in these deliberations was of great value.

The market for the "Singapore canned pineapple" depends largely on its cheapness. If this trade is to be maintained, due regard must be paid to this point. The improvement of the product is also rendered difficult because of the large number of descriptions of packing that are produced for particular demands of the trade, and also on account of the fact that grading varies in each factory. The pineapple packers formed an Association to protect their interests and to regulate quality and description of exports. It is perhaps too early to review the result of this combine, of which every packer is a member.

The pineapple export trade of Malaya is capable of extension, and there is evidence that the future may see an expansion which will open up a new area for this industry in Malaya.

Publications.

The following articles were published in the Malayan Agricultural Journal.

The Production and Marketing of Gambier, Vol. XIV, No. 2.

Marketing of Derris, Vol. XIV, No. 3.

Annual Report 1925, Vol. XIV, No. 6.

The Betel Nut Industry, Vol. XIV, No. 7.
in addition to a quarterly London Market Price list of local Agricultural Products.

The Malay publication of the Department, "Warta Pertanian-an Tanah," was published quarterly and the fourth volume completed. It included special articles on Cultivation and diseases of rubber. Care of goats, The Rhinocerus Beetle of Coconuts, Rats in padi, Diseases of goats, Tapping

rubber, Method of planting melons and gourds, Gambier, The giant snail, in addition to editorial notes and miscellaneous agricultural news. The volume included 12 full page illustrations.

The number which contained the articles on cultivation and diseases of rubber consisted of 10,000 copies, and was in considerable demand throughout the Peninsula. 3,000 copies of each of the remaining these issues were distributed.

A series of special agricultural pamphlets in the Malay language was started; the number published and distributed during the year being:—

No. 1 "Kerumut" (a pest of padi in Pahang).

No. 2 Tapping of rubber.

The total expenditure on the Malay publications (excluding salaries) amounted to $1,517.72, while sales ($928.40) and advertisements ($525) gave a total revenue of $1,453.40. Distribution was free in the Federated Malay States and Straits Settlements.

Of the old series of Agricultural publications in the Malay language, 11,821 copies were distributed, which practically exhausted the stock.

Arrangements were made to commence a quarterly Chinese publication early in 1927.

Agricultural Shows and Exhibitions.

The writer officiated as Honorary Organising Secretary of the Malayan Agri-Horticultural Association during the year.

The Association organised the Fourth Malayan Exhibition at Kuala Lumpur August 27—30 inclusive. The function proved of considerable educational value, and great competative keenness was shewn in all sections. Fifty thousand visitors attended the Exhibition.

Under the auspices of the Association, nine Agricultural Shows were held as follows:—

Malacca 26 and 27 January.
Seremban 10 July.
Taiping 14 and 15 August.
Temerloh 16 August.
Raub and Bentong 4 September.
Teluk Anson 11 and 12 September.
Kuala Langat 18 September.
Jelebu 16 December.

The Association now consists of a Central organisation and seven branches, with a total membership of 1,208. Accumulated funds in the Central organisation amounted to nearly $18,000, while Branches possess a further $12,000 of assets.

General.

Many miscellaneous subjects concerning agricultural economics were dealt with during the year.

Efforts were made to keep the Malay States Information Agency more closely in touch with the Department by periodic latters relating to recent Agricultural advances in Malaya. The collection of lantern slides at the Agency was further augmanted by 47 photos of agricultural subjects.

The writer acted throughout the period under review as Assistant to the Secretary for Agriculture and Accountant, in addition to his own duties. He also took over the administrative duties of the Agricultural Instructor (Malay Officers) from April 10 to December 4th during the absence on leave of the Agricultural Instructor (Malay Officers).

The Agricultural Economist served on a Committee appointed to draw up proposals for a School of Agriculture. The report of this Committee was submitted to Government in December.

Report of the Agricultural Instructor, (Malay Officers), for 1926.

Staff.

1. The Agricultural Instructor, (Captain J. M. Howlett. M.C.), proceeded to Europe on long leave on April 10th., and returned on December 4th., 1926. During his absence, Mr. D. H. Grist was in charge of the administration of the Instruction Division, while training-lectures were carried on by Senior Officers of the Department, and by the Assistant Agricultural Instructor, Raja Mahmud.

2. Captain Howlett, on his return, transferred to the Field Division, and Mr. G. E. Mann (from the Field Division) took over as Agricultural Instructor (M.O.).

Malay Apprentices.

3. At the beginning of 1926, there were 23 1st. Year Apprentices in training, recruited as follows:—

For the F.M.S.	...	15
For the S.S.	...	3
For Johore	...	4
For Kedah	...	1
Total	...	23

4. 22 of the above 1st. Year Students proceeded to their 2nd. Year training in May, 1926, (one Johore Apprentice having resigned).

5. 11 new Malay Apprentices were appointed in May, 1926, recruited as follows:—

For the F.M.S.	...	9
For the S.S.	...	2
Total	...	11

These constitute the present 1st. Year Class.

6. I much regret to have to record the death of one Malay Apprentice (2nd. Year Student) on May 7th., 1926, as the result of an accident.

Of the remaining 2nd. Year Students, one Apprentice (Johore) was dismissed on 30.11.26, and one (F.M.S.) resigned on 31.12.26.

No casualties occurred among the present 1st. Year Students.

The number of Apprentices in training at the end of the year, therefore, was:—

2nd. Year Students	...	19
1st. Year Students	...	11
Total	...	30

TRAINING.

7. Three terms were held during the year, as follows:—

3rd. term. 11th. Jan. to 13th. March	...	(52 working days)
1st term. 3rd. May to 31st. August	...	(100 working days)
2nd. term. 23rd. Sept. to 15th. Dec.	...	(70 working days)
Total	...	222 working days.

8. The terms are so numbered because the training year commences at the end of April or early in May. This arrangement is unavoidable, as recruiting depends on the results of the Cambridge Local Examinations, which are not available until April.

9. Lectures were given by the Agricultural Instructor and Assistant Agricultural Instructor until the former went on leave. Subsequent lectures, until the end of the year, were given by Senior Officers as follows:—

Agric. Chemist	Major Eaton	Chemistry	(2nd year Students)
Chief Field Officer	Mr. South	Botany	,, ,,
Asst. Govt. Entomologist	Mr. Gater	Entomology	,, ,,
Govt. Mycologist	Mr. Sharples	Mycology	,, ,,
Agriculturist	Mr. Bunting	Agriculture	(1st & 2nd ,,)
Asst. Agric. Chemist	Major Georgi	Chemistry	(1st Year Students)

The remaining lecture-work for 1st. Year Students was carried out by the Assistant Agricultural Instructor.

10. Instruction in Typewriting was given to all Apprentices at the Gombak Lane Malay School one evening a week, during term time, from June to December.

11. One hour a week has been devoted to lectures by Malay Apprentices, and a similar period to debating, the object being to improve their standard of English, which is at present unsatisfactory.

Examinations.

12. At the end of the year, the 2nd. Year Students were given Final Examinations in Entomology, Mycology and Chemistry, and progress Examinations in Botany and Agriculture. The results are tabulated in Appendix A to this report.*

13. It is interesting to note from these results that the higher places at present are occupied almost exclusively by Apprentices recruited from the north of the Peninsula, whilst Selangor Apprentices are, on the whole, poorly placed. Various explanations can be suggested for this (e.g. the scheme for Malay Officers in this Department is not sufficiently attractive to people near enough to the Federal Capital to be in touch with vacancies in other Departments), but I hesitate to draw conclusions from one year's results only.

14. Similar Examinations were held for 1st. Year Students, vide Appendix B.*

15. Lectures will be continued by the Agricultural Instructor and Assistant Agricultural Instructor during the coming term, at the conclusion of which the results of all the Final Examinations will be considered for purposes of promoting 2nd. Year Students to Junior Agricultural Assistants, and 1st. Year Students to 2nd. Year Students.

Health.

16. The Health of the Malay Apprentices during the year has not been satisfactory, with consequent disorganisation, to some extent, of their training. The main cause of ill-health has been fever, and I propose to inspect the surroundings of the Apprentices' quarters at regular intervals, to see that they are reasonably free from breeding grounds of mosquitoes.

Discipline.

17. The earlier quarterly reports of the Agricultural Instructor (M.O.) in 1926 draw attention to a certain lack of discipline among Malay Apprentices. In their present circumstances this is to a certain extent inevitable. But it is hoped, by fostering esprit de corps and by other methods, to improve discipline generally. The task would be far easier if the School were located (even in its present form) at Serdang instead of in Kuala Lumpur.

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* (Appendices A & B referred to above are omitted from this report).

GENERAL.

18. 16 present 2nd. Year Students are members of the M.V.I. It is proposed to encourage 1st. Year Students also to join.

19. The Annual Malayan Exhibition was held in Kuala Lumpur from 27th. to 30th. August, 1926: most of the Malay Apprentices assisted.

20. No Conference of Malay Officers was held during the year.

21. At a meeting of the Malay Officers Training Committee held on 24th. December, 1926, it was decided that the training year should consist of 40 weeks, and that Bulan Puasa should not be regarded as a holiday.

22. Enquiries are being made by the Agricultural Instructor (M.O.) as to the possibility of reviving the Agricultural Department Football Club. It is felt that additional interests of this nature will prove of considerable benefit not only to the Malay Apprentices but to all subordinate officers stationed at Headquarters.